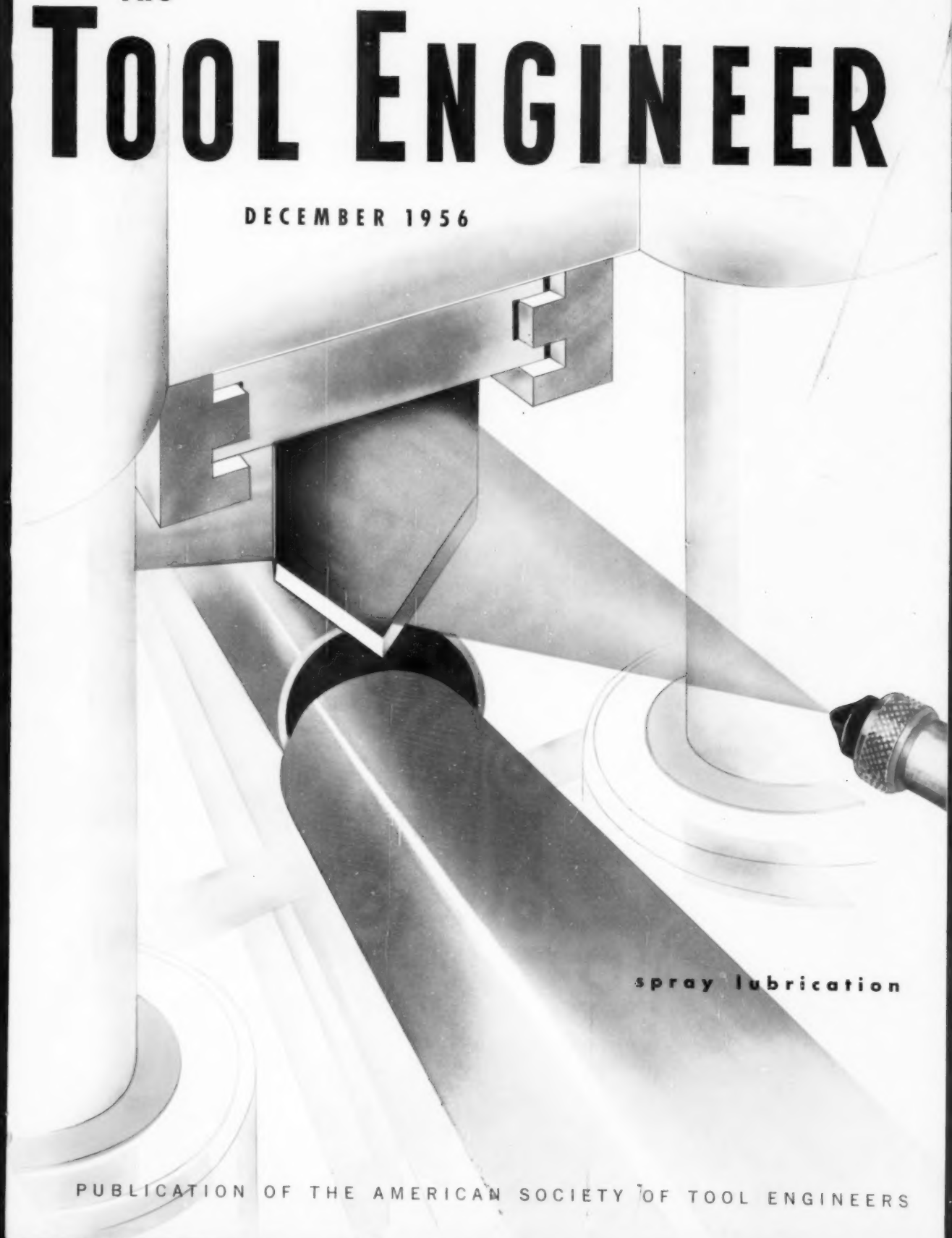
the

TOOL ENGINEER

DECEMBER 1956



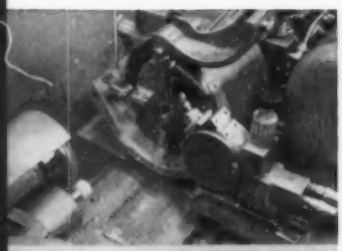
spray lubrication

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

8 Ways to COMBINE

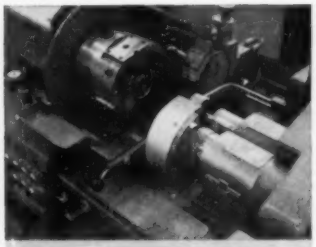
BORE and FACE GRINDING OPERATIONS

with Heald Multi-Spindle Internals



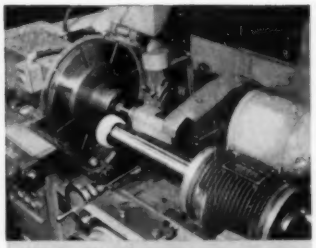
SIMULTANEOUS Bore and Face Grinding with SLIDE-BAR FACING

Bore grinding wheel reciprocates with table while facing wheel, mounted on anti-friction slide bars, is held forward against work under spring pressure. Face feeding stop controls depth of face grind.



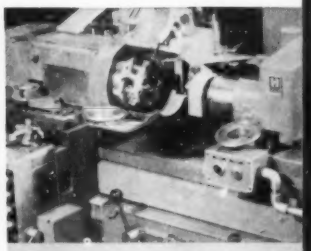
SEQUENTIAL Bore and Face Grinding with MANUAL FACING

Face is first plunged with manual facing attachment, while bore wheel enters bore without contacting work. Bore is then ground in Size-Matic cycle (facing wheel positioned to clear work on instroke).



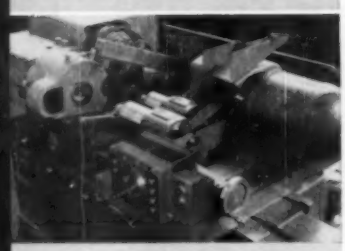
SEQUENTIAL Bore and Face Grinding with RETRACTABLE FACING HEAD

With motorized facing wheelhead in extended position, face is plunge ground with manual feed (bore wheel is clear of work). Workhead is indexed forward and bore ground in Size-Matic cycle.



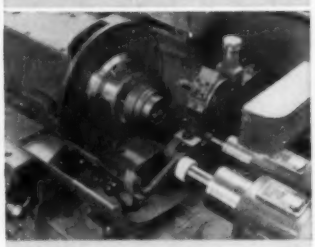
SIMULTANEOUS Bore and Bottom Face Grinding with SINGLE WHEELHEAD

Combined bore and facing wheel feeds against work while workhead feed is operating, grinding face to finish size and plunging bore to semi-finish size. Wheel plunges bore to finish size while held clear of face.



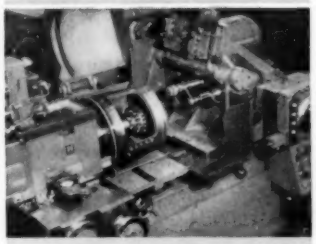
SEQUENTIAL Grinding of Two Bores and Bottom Face with SPACED WHEELHEADS

Small bore first ground to size (second wheel clears work), then workpiece is indexed forward in front of second wheel. Large bore is plunge ground and at same time wheel is fed forward to face grind bottom face.



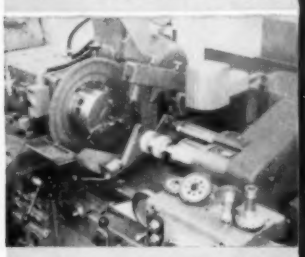
SEQUENTIAL Bore and Bottom Face Grinding with SPACED WHEELHEADS

With workhead in rear position, bore is ground in Size-Matic cycle (facing wheel spaced to clear work). Work is then indexed forward and face is plunge ground to finish size, (bore wheel clears work).



SEQUENTIAL Plunge Grinding of STRAIGHT AND CONTOUR BORES

Two wheelheads first plunge grind large straight bore and spherical ball race. Work is then indexed forward and small combined straight and taper bores are plunged with shaped wheel.



SEQUENTIAL Grinding of I.D., O.D. and FACE with Spaced Wheelheads

Bore is first ground to finish size with workhead in rear position (face and O.D. wheels clear of work). Workhead indexes forward and bottom face and two O.D.'s are plunge ground with double wheel.

WHENEVER two or more grinding operations can be done at a single chucking, you convert handling time into *grinding time*. What's more, you get a more positive relationship between ground surfaces than could be obtained by any other method. Here are eight different Heald setups for performing such combined operations quickly and economically. For complete information, send for a copy of new Bulletin No. 2–69–2.

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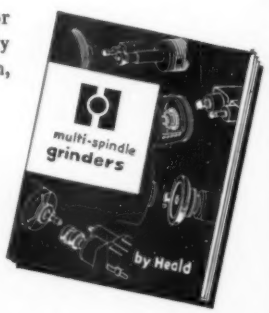

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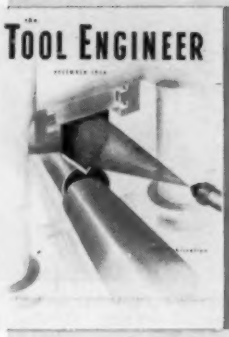
COVER: Spray application of drawing compounds and lubricants is faster than manual methods and lends itself to automation. Some typical installations of spray equipment are discussed in an article beginning on page 81, with emphasis on the practical information necessary to plan a successful installation.



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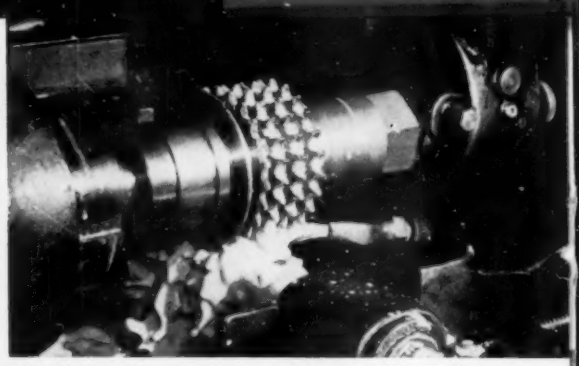

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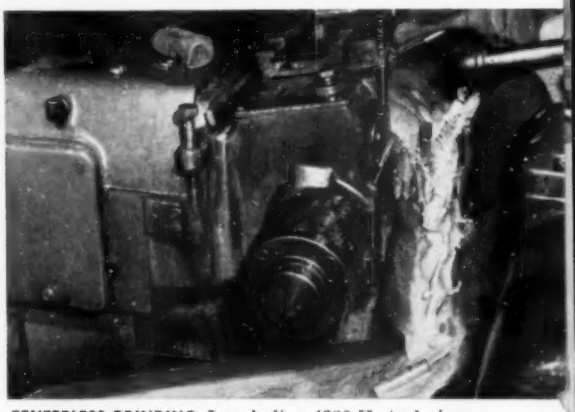

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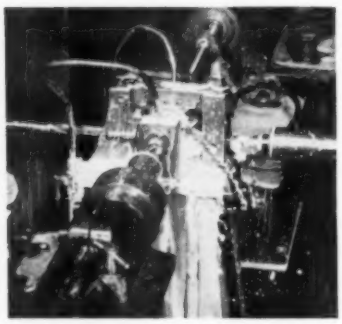

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The Tool Engineer

Why Not Be Professional?

Professionalism or unionism seems to be a choice that an engineer need not make. His work and his responsibilities are definitely professional. The Taft-Hartley law defines professionalism by the type of work performed. It is predominantly intellectual, involving judgment, and cannot be standardized. Prolonged experience or study is required. Recognizing the special nature of this type of work, the law requires that, when determining representation, the votes of professionals be separated from other votes in a plant-wide election.

Many engineers, however, are joining unions in increasing numbers. They are chiefly in the aircraft and electronics industries. Probably these engineers see advantages gained by union groups and wish to participate. They do not realize that, for them, the advantages may be temporary. The disadvantages include delegating others to speak for the individual.

The problem of protecting his profession against unionization has faced the engineer for many years. The choice between leading and following should be made with open eyes. It should have been made long ago. In fact, the student should be told in school of his responsibilities to his profession.

Recently, a group of methods engineers and design engineers at the Westinghouse Jersey City plant filed suit against the National Labor Relations Board following its decision denying them a separate vote to determine their desires for future representation. Although the group had joined the company's bargaining unit in 1950, it now wishes a decertification election. Taft-Hartley provides for decertification of "any group." Also, a previous Board ruling had granted decertification to professionals at Illinois Bell Telephone. The basic question in this suit is of vital interest. Do people have a right to decertify?

When all engineers are imbued with their responsibilities and when management provides the proper environment for development, there will be no question of the professionalism of the engineer. He will be proud to be an individual and to be himself. In that atmosphere his ability will be the only limit to his achievements.

John W Greve

EDITOR

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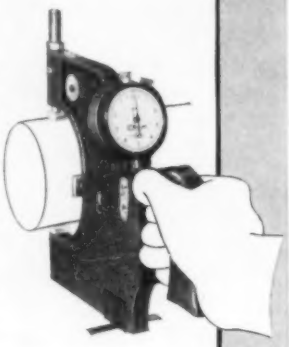

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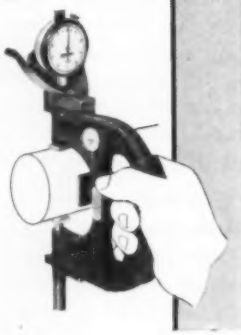

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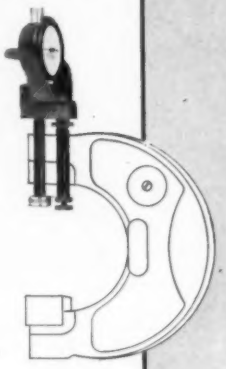

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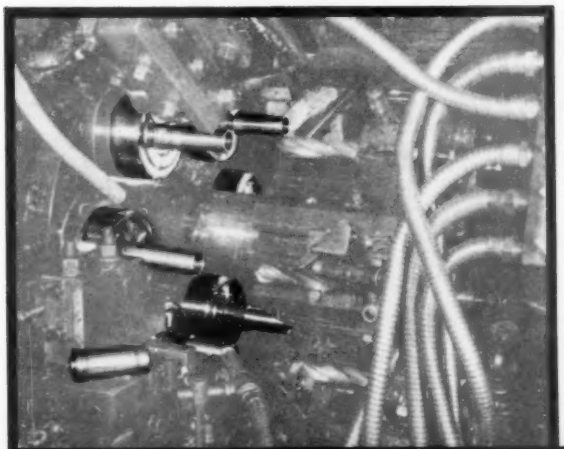

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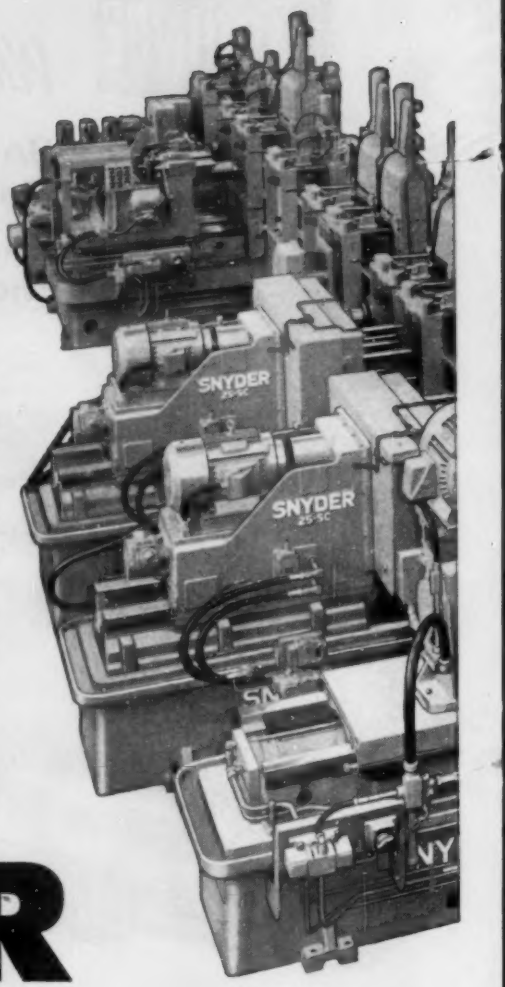

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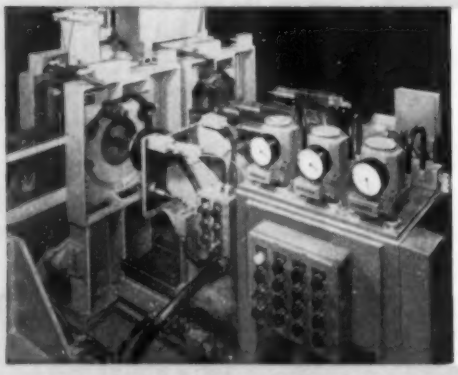
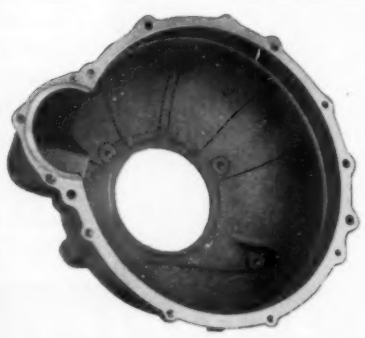
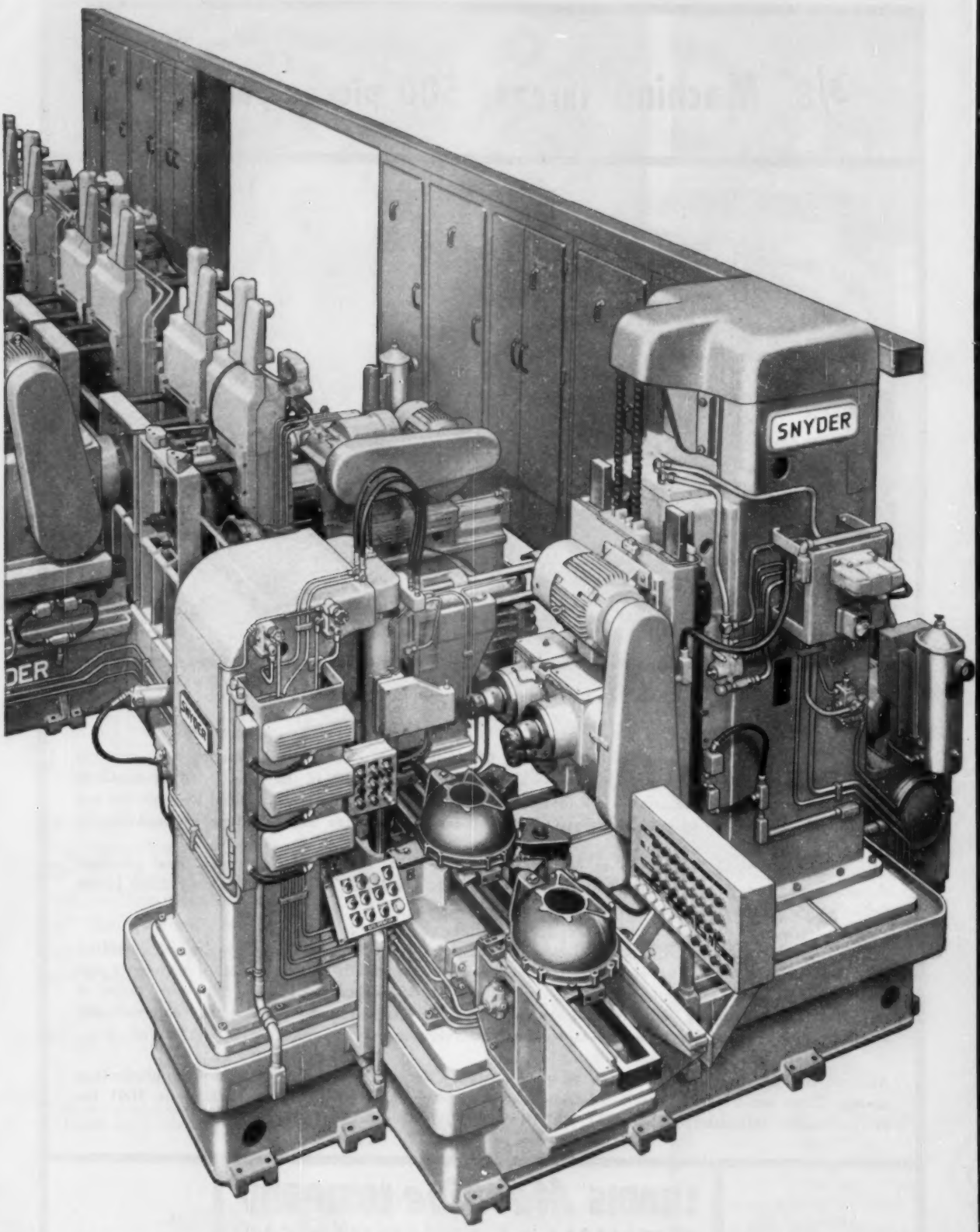




Boring and air gaging stations.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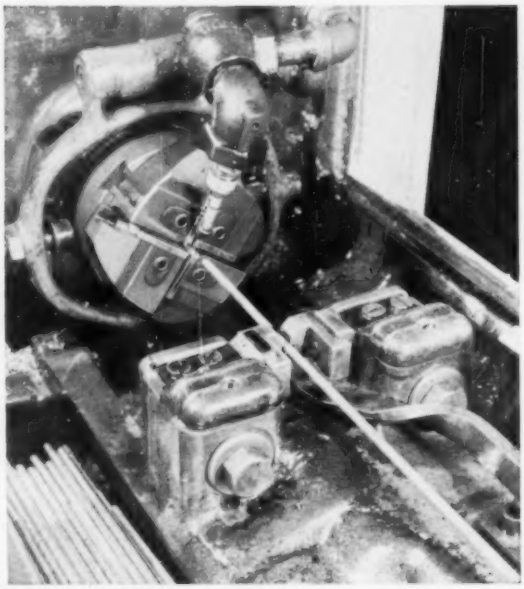

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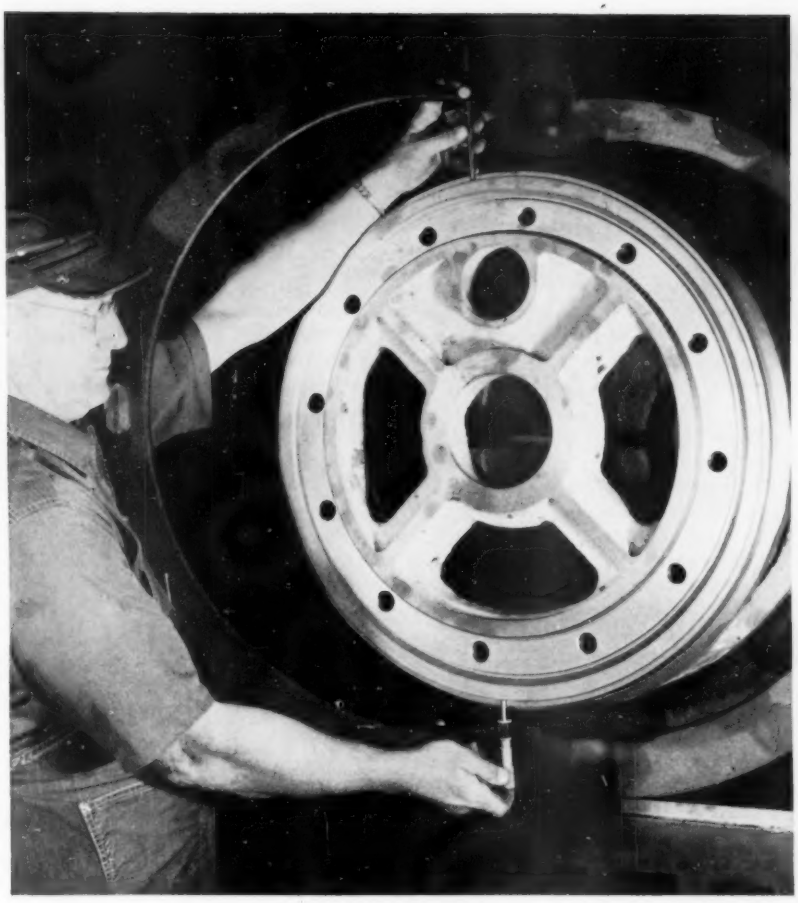

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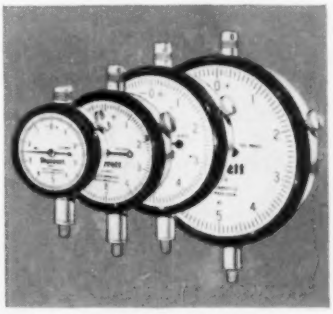

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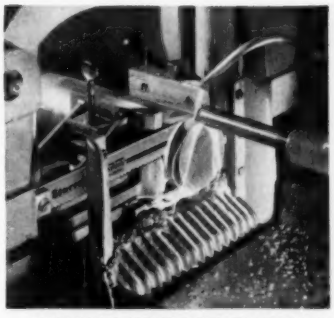

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"Operations Kingsbury" . . . change die castings into interchangeable pump bodies

This oil pump body starts with a die casting. The piece is not machined prior to the time it enters the Kingsbury. When it leaves the Kingsbury, it's ready for assembly.

Work is required from three general directions: the mounting surface, the cover face and the top. It was decided to perform all operations in two chuckings, passing each piece through the machine twice.

The central column machine has 18 Kingsbury units — six with auxiliary heads. Twenty work-holding fixtures are mounted in pairs on an index table which indexes through ten stations — one for loading and unloading.

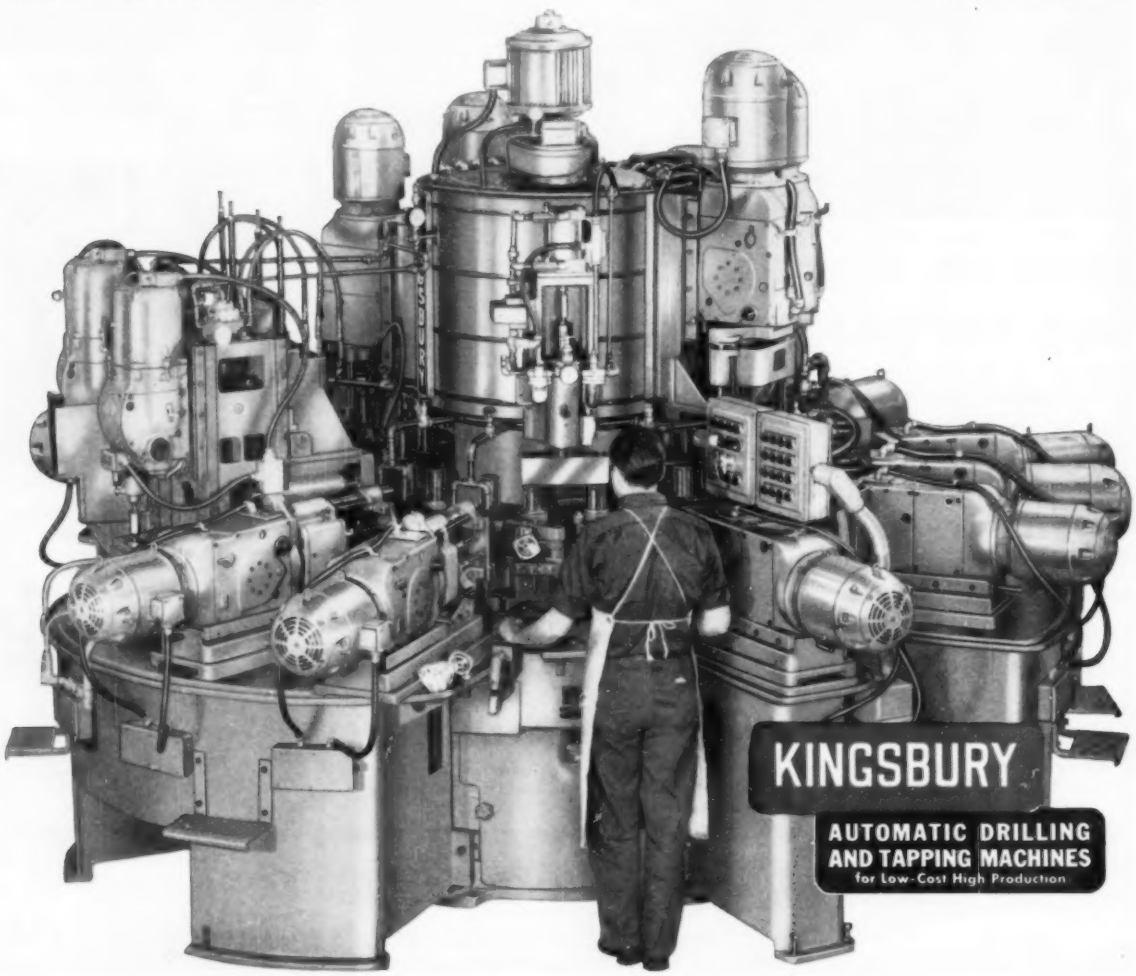
Operator places the die casting in the right-hand fixture, locating the pre-formed hole (No. 10) over a spring-actuated plug. A spring loaded ram closes the fixture, locating the piece correctly.

In the first trip through the machine, 14 spindles complete six holes and mill the mounting face. This work provides an accurate surface with precise locating points for the second chucking, in which 17 spindles complete eight holes and mill and trepan the cover face.

Result . . . each milled surface is uniformly accurate in finish and angle relationship — each hole is of proper size and is located correctly. Result again . . . interchangeability, which is what was wanted, plus rapid and economical production, of course.

An automatic machine cannot produce uniformly accurate work unless its work-holding fixtures are *designed correctly and precision-built.* You get *both* when you get a Kingsbury.

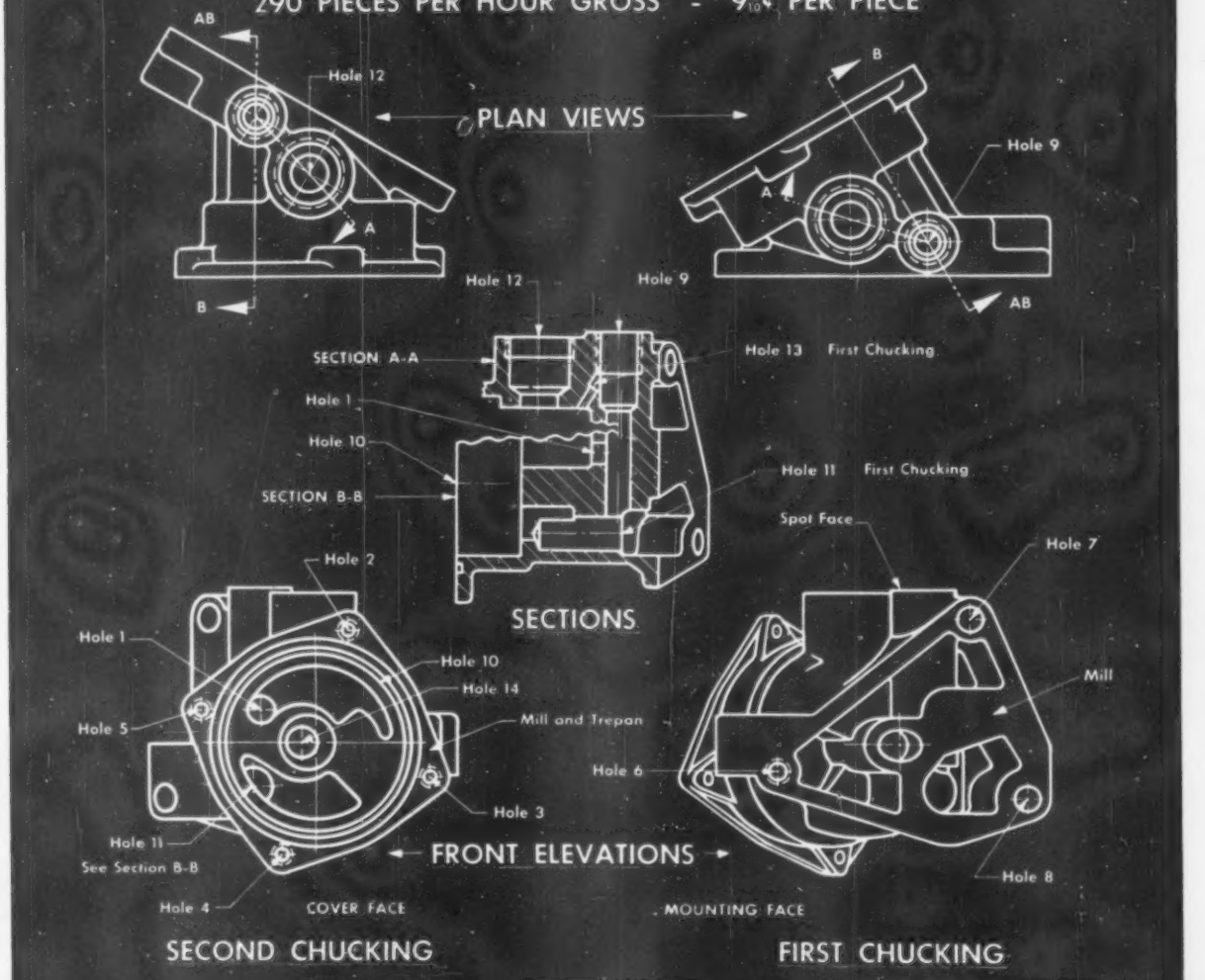
Kingsbury Machine Tool Corporation
120 Laurel Street
Keene, New Hampshire

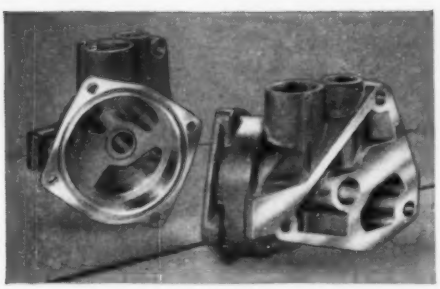


OIL PUMP BODY - Aluminum Alloy Die Casting

32 SPINDLE OPERATIONS FROM FOUR DIRECTIONS

290 PIECES PER HOUR GROSS - 9 9/10¢ PER PIECE



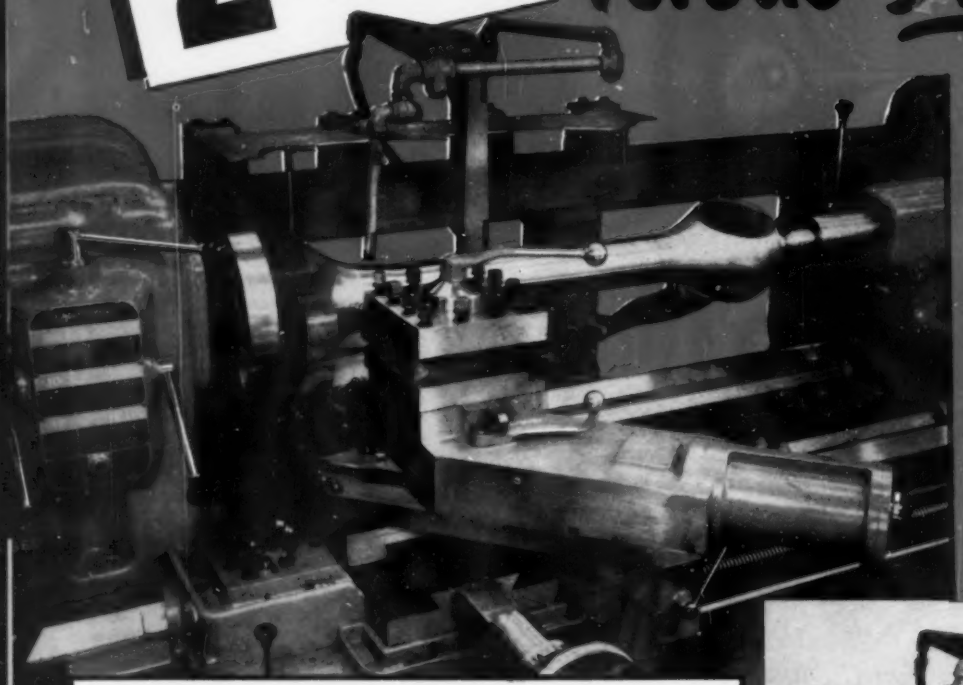


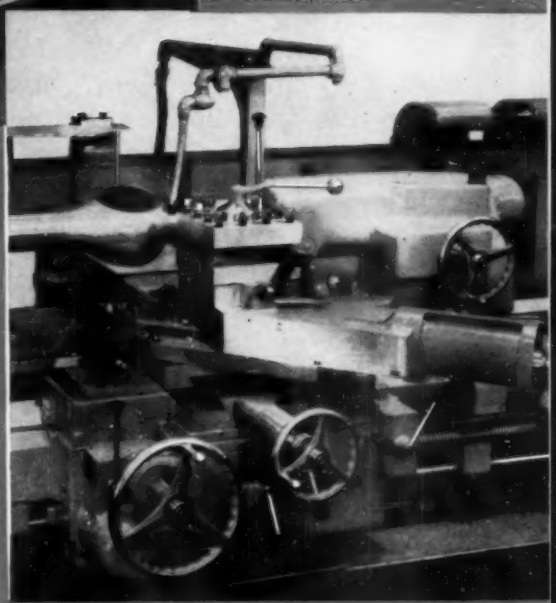
Mirror photograph shows 13 of the 14 holes, and the two surfaces — completed in two chuckings.

FIRST CHUCKING		
HOLE NO	STATION	WORK
6	1-H 4-H 8-H	Tap Drill Undersize Ream Tap
7	1-H 4-H	Drill Undersize Ream
8	1-H 4-H	Drill Undersize Ream
9	4-V 5-V 8-V 9-V	Core Drill Undersize (two dias.) Spot Face Boss Ream Tap
11	6-HR	Drill to remove Flash
13	7-AR	Drill
Mount Face	2-V	Mill

SECOND CHUCKING		
HOLE NO	STATION	WORK
1	1-H	Core Drill
2	1-H 3-H	Tap Drill Tap
3	1-H 3-H	Tap Drill Tap
4	1-H 3-H	Tap Drill Tap
5	1-H 3-H	Tap Drill Tap
10	4-H 6-H 7-H	Comb. Rough Bore* Finish Bore Finish Bore
12	7-V 8-V	Ream Tap
14	8-H 9-H	Rough Ream Finish Ream
Cover Face	2-V 4-H	Mill *Comb. Trepan

2 hrs. — versus 9½ hrs.





This marine Diesel engine connecting rod is now roughed and finished from the rough forging in exactly 2 hours. It formerly required 9½ hours to do the same job.

With production costs constantly reaching new peaks, industry simply can't afford to ignore such savings from modern equipment. Where else could such a magnificent return upon an investment be secured, and how else can costs be lowered to meet an increasingly competitive market?

More production per man hour is the answer and the only answer to prohibitive costs—modern, high production machinery is the answer to greater production per man hour.

The astounding saving on this connecting rod job is the result of transferring it from previous equipment to a new 32-inch "AMERICAN" Hydraulic Duplicating Lathe. Such savings as this are not the exception but the rule when "AMERICAN" Duplicators are put on the job.

Bulletin No. 35 shows many such examples—it's yours for the asking.

THE AMERICAN TOOL WORKS CO. **Cincinnati, Ohio U.S.A.**

Lathes and Radial Drills

. . . NO BLACK MAGIC OR "HOCUS-POCUS"

We have no Secrets!

. . . JUST THE BEST DRILL BUSHINGS!

With precision American drill bushings you get: the *best* tool steel for extra long bushing life; the *best* 100% concentricity inspection; the *best* ordering method — eliminates confusing code numbers; the *best* range of standard sizes — smallest to the largest; and the *best*, most complete local stocks anywhere. Because we specialize only in the manufacture of drill jig bushings, American is your *best* drill bushing buy!

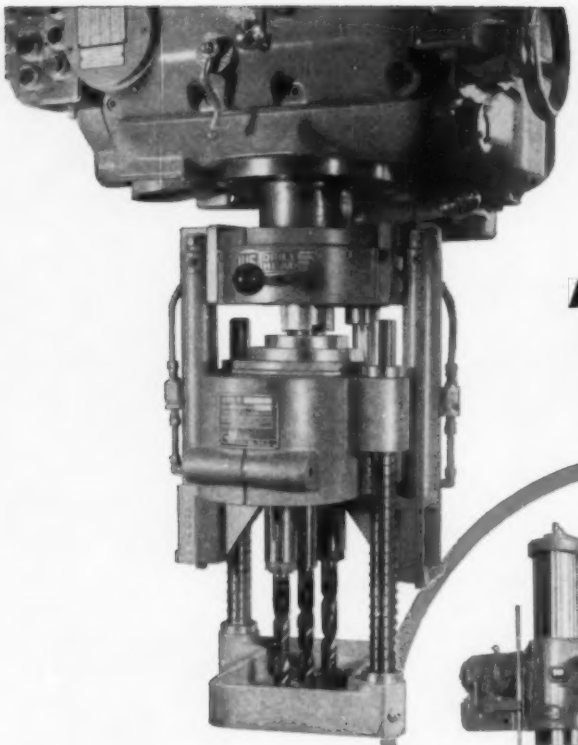
Send for our new 1957 catalog, price lists, and name of exclusive distributor near you.

American

DRILL BUSHING CO.

5107 PACIFIC BOULEVARD

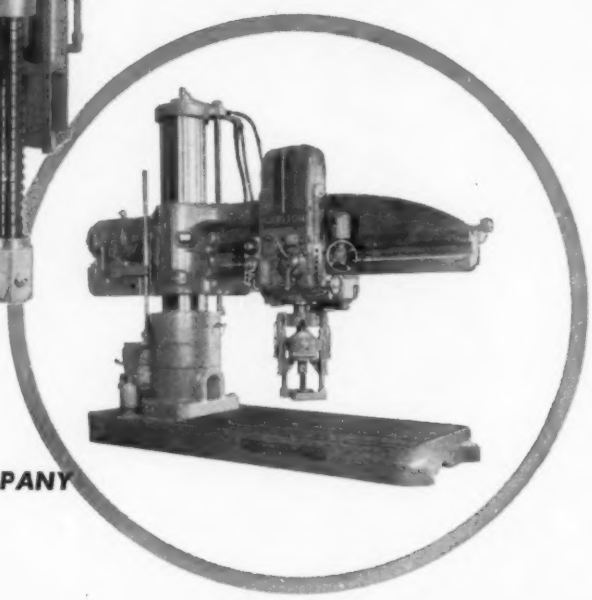
LOS ANGELES 58, CALIFORNIA



New

DRILL HEAD AIR COUNTERBALANCE SWIVEL ATTACHMENT

FOR RADIAL DRILLING MACHINES



THIS IS ANOTHER FIRST FOR THE U. S. DRILL HEAD COMPANY

This new combination Swivel and Air Counterbalance attachment makes it possible to adapt large multiple spindle drill and tapping heads to radial drilling machines.

Flexible and easily adjusted, it insures maximum safety for the operator, as well as better operating economy.

Two cylinders maintain a balanced condition of the head on the machine, with the air in the counterbalancing setup being controlled on both ends of the stroke. Therefore, only sufficient pressure is maintained to counterbalance the weight of the head during all portions of the stroke. On the return stroke, the air is controlled to prevent extreme, quick return of the head. Attachment includes air filter, pressure regulator, and an air oiler, and incorporates a 360° swivel feature fully aligning the drill head. It operates equally well with the fixed center type head and the adjustable type head.

This package is ideally suited for drilling condenser plates, boiler tube sheets, flue sheets, etc.

FOR MEN WHO KNOW DRILL HEADS BEST, IT'S ALWAYS U. S. DRILL HEAD — FIVE TO ONE

Manufacturers of all types of Fixed Center, Adjustable, and Individual Lead Screw Tapping Heads.

US DRILL HEAD

THE UNITED STATES DRILL HEAD COMPANY

BURNS STREET • CINCINNATI 4, OHIO

A "natural" for aircraft parts

New! Revolutionary!

Colonial
ONE-WAY
Surface Broacher

"Eliminates" Return-Stroke
"Eliminates" End of Stroke
"Doubles" Length of Stroke

For complete information on the new Colonial ONE-WAY surface broacher, ask for Bulletin VC-55.

MECHANICAL DRIVE AC MOTOR
VARIABLE SPEED
HYDRAULIC OR MECHANICAL FIXTURES
CARBIDE OR HSS BROACHES
NO PIT REQUIRED FOR LOW CEILING
LONGER TOOL LIFE

EXTREME ACCURACY GUARANTEED
STROKE LENGTH UP TO 200 INCHES
SPEEDS UP TO 50 FEET/MIN.
ONE LONG STROKE— ONE PART OR MULTIPLE SHORT STROKES ON MULTIPLE PARTS
CONTINUOUS OPERATION

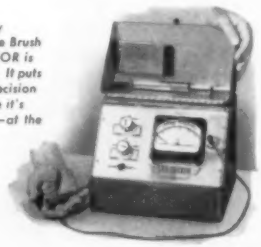
PIONEERS OF H.S.S. BROACHING
COLONIAL
BROACH & MACHINE CO. DETROIT 13, MICH.

UNIFIED BROACHING is the key to successful broaching

It's too late to check surface finish at final inspection

Overfinishing is costly—*and final!* Detecting overfinish after a part is completed can't correct it *or* restore wasted machine time. Underfinishing is also expensive because parts must be returned for re-work. Yet, checking of finish at final inspection has been common practice. In the past, only the inspector *could* make an accurate check of surface finish—not the machine operator.

On-the-spot surface finish checking was by feel or appearance. Consequently, surfaces generally were overfinished to pass inspection—far beyond any smoothness specified. Surface finish could not be measured where it was being produced—at the machine.



Weighing only 15 pounds, the Brush SURFINDICATOR is fully portable. It puts laboratory precision to work where it's needed most—at the machine.

Finish now controlled at machine

Now, Brush offers a remarkable new instrument that can be used *right at the machine*, as well as in the inspection department or laboratory. The Brush SURFINDICATOR* accurately and immediately indicates the exact surface finish produced.

Simple to use

The SURFINDICATOR can be used by anyone. The hand-held stylus is simply passed over the surface in question, and an accurate measurement in micro-inches is instantly obtained. It permits the machinist to check his work *as he works*, and provides him with a guide for further finishing. Fully portable and ruggedly built, it can be used anywhere in the plant, anytime.

The Brush SURFINDICATOR provides accurate surface finish control wherever needed—on metals, glass, plastic, paper, wood and other surfaces for maximum finishing economy.

Write for your free copy of this informative new booklet on surface finish control . . . it includes new ASA standards for surface roughness, waviness and lay.

It is important that you get complete information at once on the Brush SURFINDICATOR together with the new ASA standards for measuring surface smoothness. Both are contained in the new booklet offered—write for it today! *T.M.

BRUSH ELECTRONICS COMPANY

3500 Perkins Avenue, Cleveland 14, Ohio

BRUSH 6 ELECTRONICS

DIVISION OF CLEVITE CORPORATION

TOOL LIFE INCREASED 400%

CLEVELAND Carbide Tipped Adjustable Reamer sets new high record!

The specifications on this job call for reaming a 4½" hole to a tolerance of .001" and a surface finish of less than 50 R.M.S. (micro-finish). CLEVELAND Carbide Tipped Adjustable Reamers are meeting these requirements day after day... month after month... *and reaming five times as many holes per grind as the conventional high speed reamers formerly used.*

Whenever *you* have a difficult reaming problem, a CLEVELAND Service Representative can help you. Contact our nearest Stockroom, or...

TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR

Request your copy of this descriptive booklet on CLEVELAND Carbide Tipped and Solid Carbide Cutting Tools

THE CLEVELAND TWIST DRILL CO.

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MULTI-FLEX

A Versatile Line of Boots, Connectors, Bellows, Tubes, Air Ducts

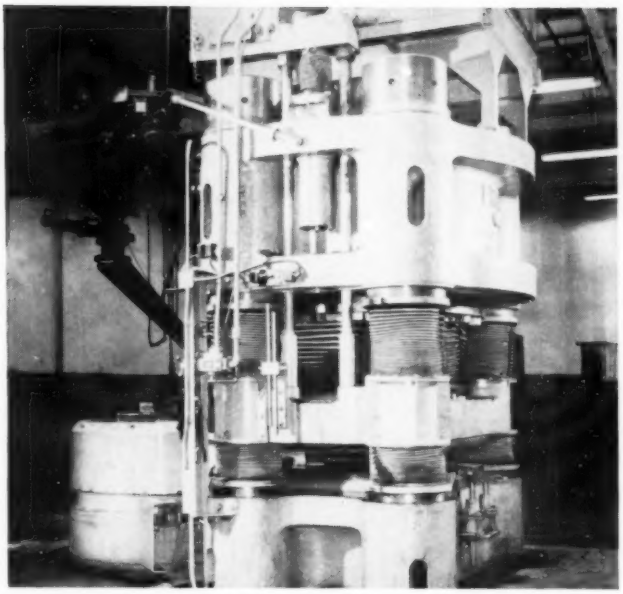
If the equipment you make requires

- accordion protective boots
- connectors to take bends or movements in compression or extension
- bellows to move air or be actuated by air
- extremely flexible tubing that will not kink

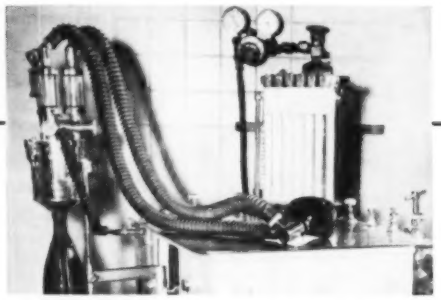
you'll do well to investigate U. S. Multi-Flex.®

Made circumferentially corrugated without molds or other tooling, in inside diameters ranging from ¾" to 48", and engineered to your particular requirements, these products may furnish the answer to difficult-to-solve application problems.

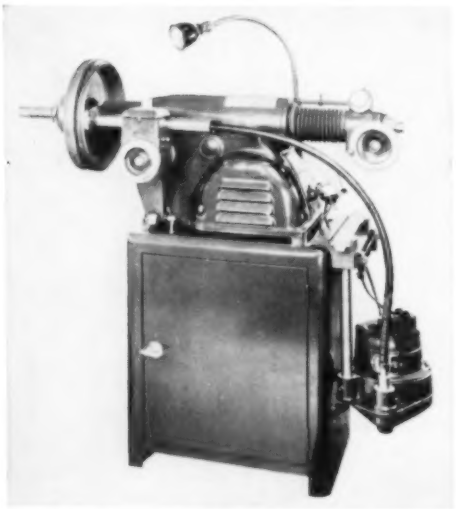
Get U. S. Multi-Flex, plus expert engineering service, at any of the 28 "U. S." District Sales Offices, at selected distributors, or by writing us at Rockefeller Center, New York 20, N. Y. In Canada, Dominion Rubber Co., Ltd.



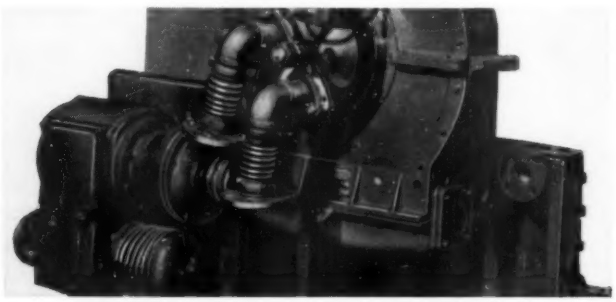
Multi-Flex laced boots keep dirt and grit out of hydraulic rams. They are laced for easy installation without dismantling press.



Multi-Flex conductive tube—extra-flexible and lightweight—in use on anesthesia equipment.



Multi-Flex boots giving constant protection to the shaft on this brake drum lathe.



Multi-Flex connectors on vacuum filter, taking care of axial movement and misalignment.

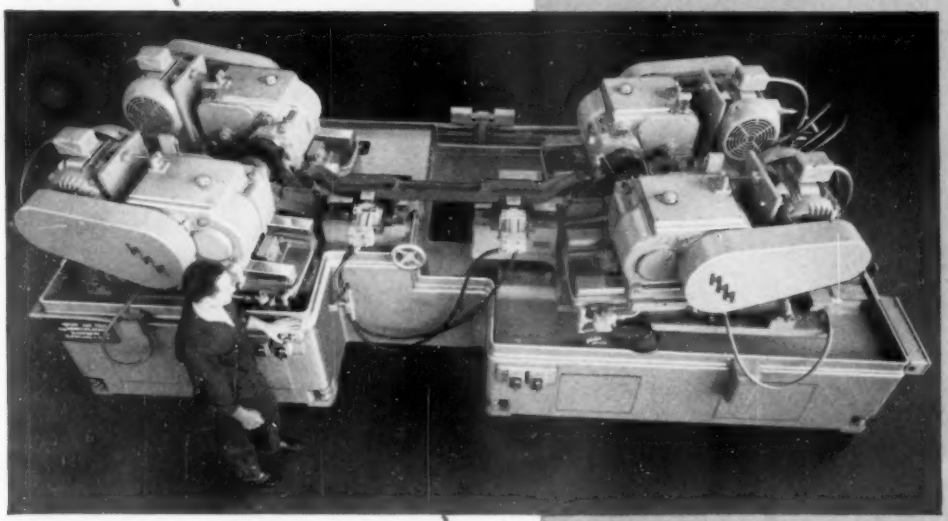
Mechanical Goods Division

United States Rubber

MIGHTY BIG JOB

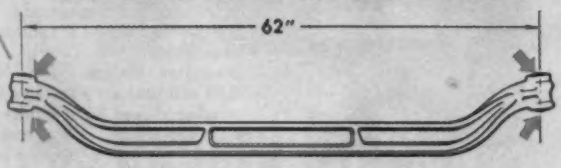
MINIMIZED by another

MOTCH & MERRYWEATHER *Production Solution*



Traveling head universal double duplex milling machine.

YOU'RE AHEAD WITH A HEAD FOR EACH SURFACE



Operation: Milling kingpin bosses of truck axle.
Material: . . . . . Forged steel.
Brinnel Hardness: . . . . . 217-255.
Machine cycle time: . . . . . 30 seconds

Four faces of a part are milled simultaneously by this universal-special machine. Mill faster, more accurately, at less cost with a head for each surface. Motch & Merryweather engineers can design universatility into special equipment. Thus, machines performing a specific task can be quickly adapted to a variety of sizes. Have M. & M. study your next job with a view to broadening the usefulness of ostensibly special equipment.

Write for Bulletin S-56 describing M. & M. Duplex Milling Machinery.

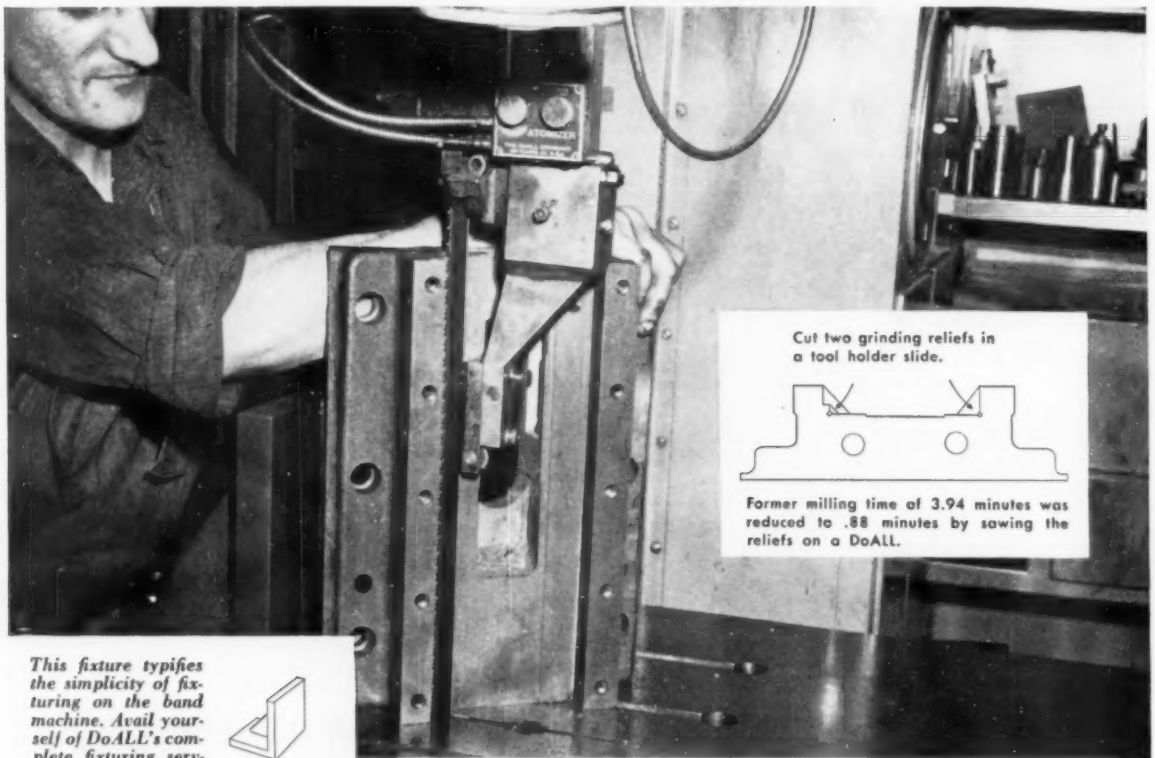
THE MOTCH & MERRYWEATHER MACHINERY CO.

MACHINERY MANUFACTURING DIVISION

CLEVELAND 13, OHIO

Builders of Automatic Precision Cut-off, Milling and Special Machinery

How Production Band Machining Reduces the Cost of Cutting Grinding Reliefs


Cut two grinding reliefs in a tool holder slide.
Former milling time of 3.94 minutes was reduced to .88 minutes by sawing the reliefs on a DoALL.

This fixture typifies the simplicity of fixturing on the band machine. Avail yourself of DoALL's complete fixturing service. Write today!

This Contour-matic is a standard design machine modified by DoALL to provide extra work height capacity required for this job. DoALL can fit your requirements, too.

The Demon H.S.S. saw band developed by DoALL is the world's fastest cutting, longest lasting saw band.

Manufacturer Does Job in ¼ the Former Time . . .

In search for new cost cutting methods, one manufacturer found that major savings could be made in machining grinding reliefs, simply by switching the job to a DoALL Contour-matic band machine.

Results: Reliefs that formerly took 3.94 minutes on a milling machine were produced in 1.33 minutes on a DoALL Contour-matic with a carbon steel saw band. Changing to the new Demon H.S.S. saw band, the time was further cut to .88 minutes, for a time saving of 78% over the former milling time. One operator now does in one hour what formerly took 4 hours!

Reasons: The continuous cutting slender saw band penetrates the metal much faster than possible with other methods. Too, the cutting force is directed downward only, thus eliminating costly hold-down fixtures and lengthy set-up time . . . only a simple back-up bar is needed.

Cutting grinding reliefs is just one of the many production machining operations that can be done faster at lower cost with a DoALL. For information and a free, in-your-plant demonstration of this new, basic production tool, see your local DoALL Sales-Service Store or write:

THE DoALL COMPANY, Des Plaines, Illinois

DoALL

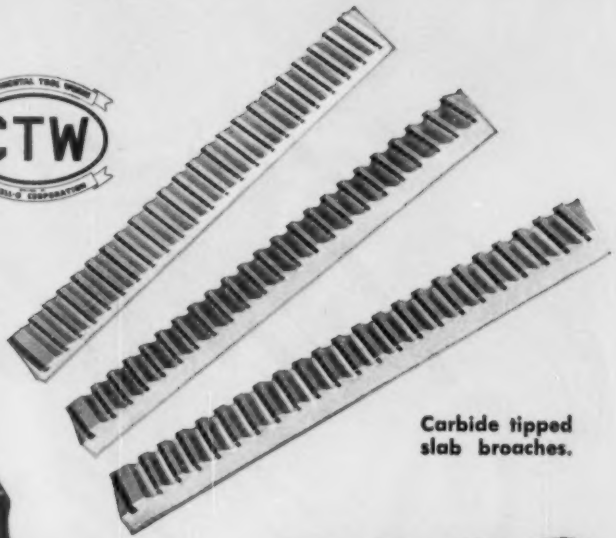
FREE LITERATURE AND MOVIES—Ask for the new 16-page band tool catalog and Contour-matic catalogs. See in sound and color, "Production Band Machining" (30 minutes) and "Production Tooling" (10 minutes)—both available for group showings.

Friendly DoALL Sales-Service Stores in 38 cities. Call yours today!

PB-31

Partial view of a conventional round hole broach. Roughing, semi-finishing and finishing teeth are shown.

Surface broach with adjustable and replaceable carbide tipped tool bits.



Carbide tipped slab broaches.

This solid carbide finishing shell fits on an arbor of a conventional round broach.

Here's Why Continental Quality Broaches Actually Cost Less Than Ordinary Broaches

After all, the price paid for a broach may be only the beginning of broaching expense. To the original cost of the broach must be added the cost of work delays, scrapped parts, and time-consuming adjustments.

However, if the broach is free cutting, holds the required tolerances and finishes, with the maximum pieces per tool, your original cost may be your only cost.

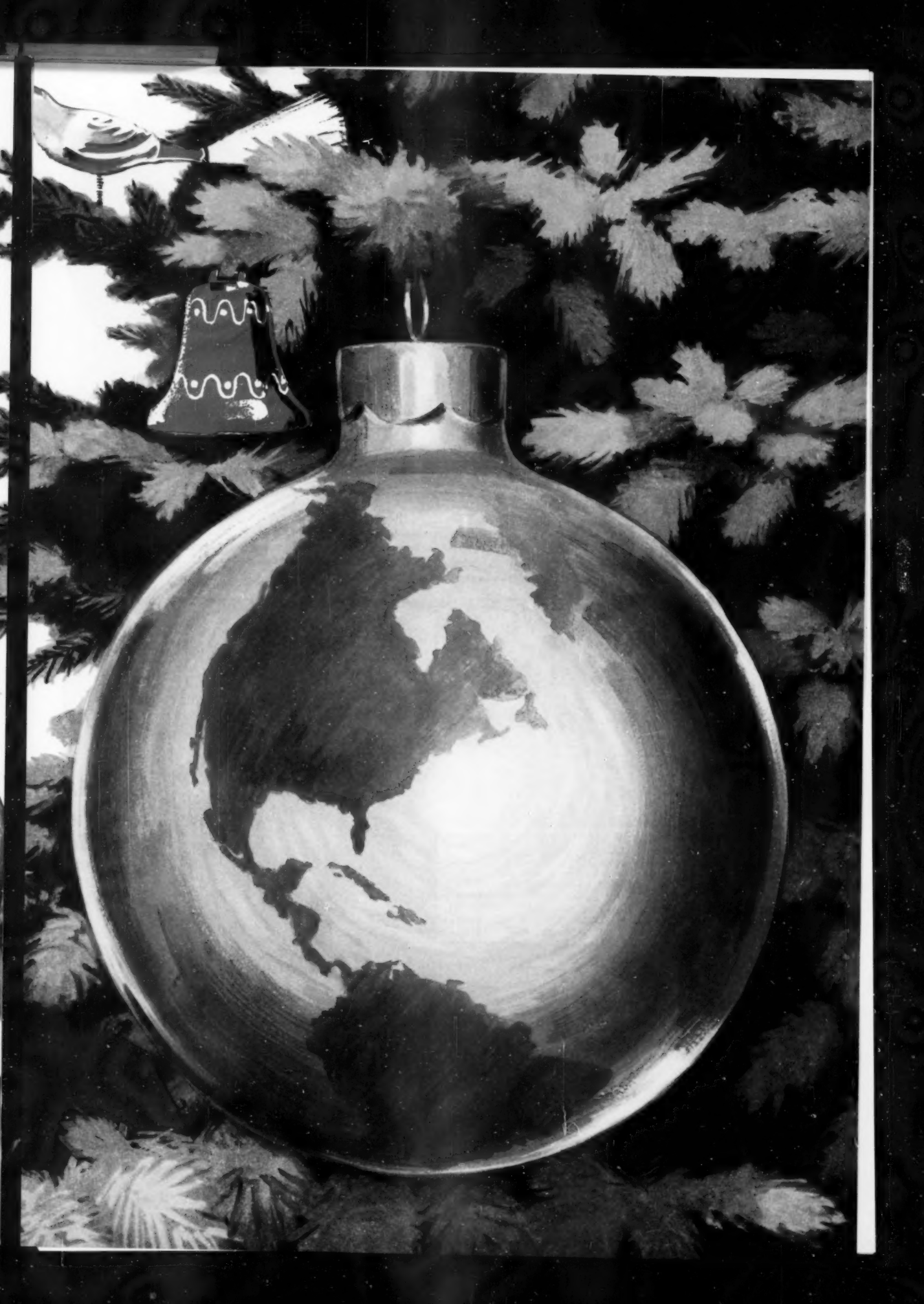
Because Continental effectively combines quality materials, skilled craftsmanship, and engineering experience, it is a fact: "the best broaches cost less."

Continental
TOOL WORKS
Division of
Ex-Cell-O Corporation
Detroit 32, Michigan

56-64

For all their Christmases give them a world of brighter tomorrows

MORSE TWIST DRILL &
MACHINE COMPANY
Subsidiary of Van Norman Industries, Inc.
NEW BEDFORD, MASSACHUSETTS



7 great lapping machines for your profit-boosting

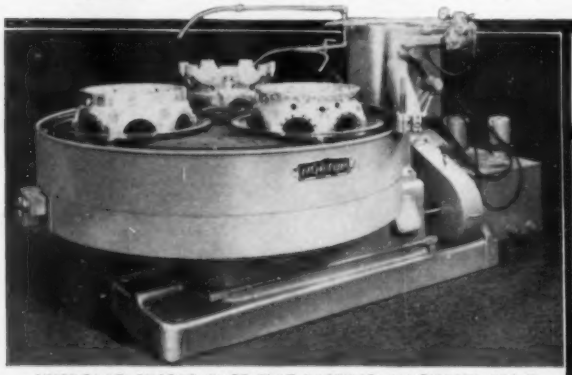
"TOUCH of GOLD"

If you are performing single or parallel face flat lapping operations you'll get real profit-boosting qualities from the ability of these machines to improve your product quality — shorten production time — lower your lapping costs. In other words — from their ability to give you the "Touch of Gold".

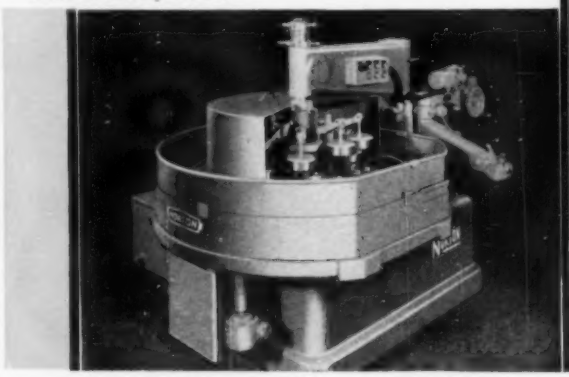
With NORTON HYPROLAP machines you'll lap fast — and get clean work on which you can do further machining without cleaning operations — because their bonded abrasive laps leave your parts free of imbedded grit. The hydraulically operated truing devices on these machines provide additional advantages in assuring truth of lap face — plus the convenient means of quickly changing lapping action by rough or fine truing of the lap by simple adjustment of the speed of the truing arm.

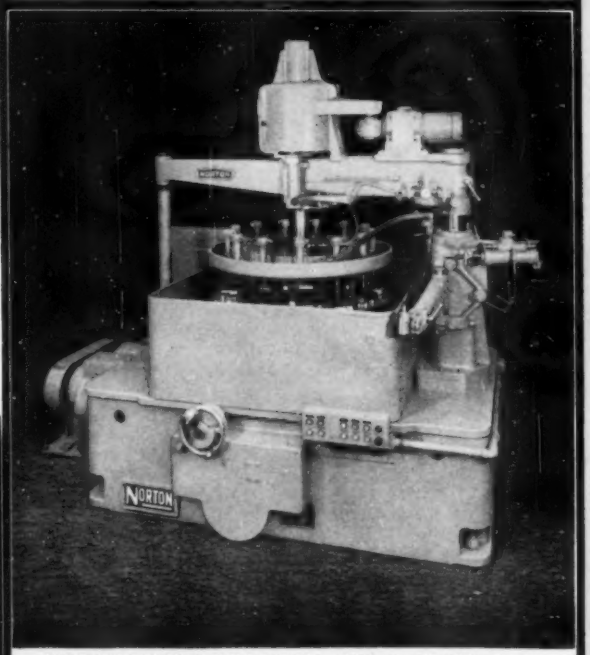
For operations requiring cast iron laps, you will get continuing high investment return — and steady, low cost production from the #16-FC and #28 Lapping Machines — because of their simplicity of operation — and outstanding durability. They'll operate steadily for you with minimum attention or maintenance — hour after hour — day after day.

For further facts see your Norton representative or write direct. And remember: only Norton offers you such long experience in both grinding machines and grinding wheels to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.

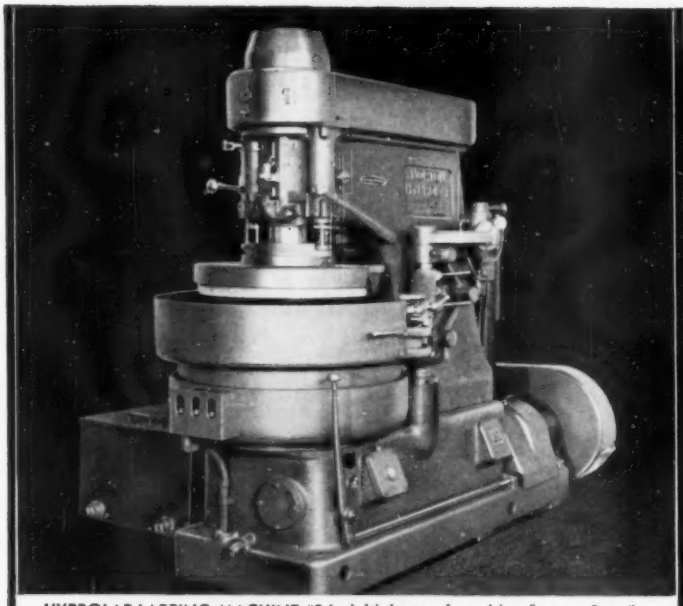


HYPROLAP SINGLE FACE FLAT LAPPING MACHINES #60-F (above) and #36-F (below). Sensational performers using bonded abrasive laps and filtered coolant. Provide clean seal surfaces, wear surfaces or reference surfaces for further machining. Available for small or large production lots: plain timed cycle; automatic continuous feed or semiautomatic continuous feed. Rigid power-operated truing arm insures true flatness of abrasive lap and finished work pieces. Heavy or light parts handled with equal ease.

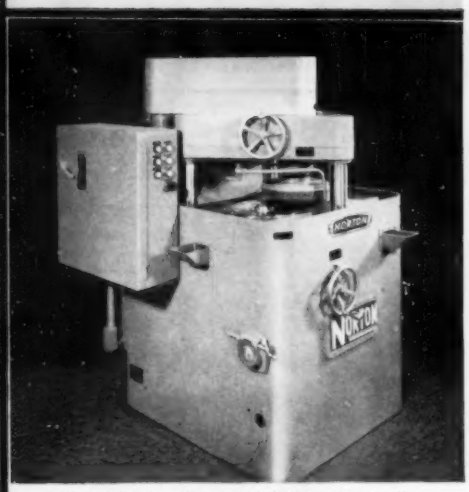




HYPROLAP SINGLE OR PARALLEL FACE FLAT LAPPING MACHINE #48-F. Similar to the #60-F and #36-F Lappers in speed and accuracy, with provision for parallel face flat lapping. For single face flat lapping the machine mounts a single 48" diameter bonded abrasive lap. For lapping opposed parallel flat surfaces an upper lap is added. Arrangements: plain timed cycle; automatic continuous feed or semiautomatic continuous feed.

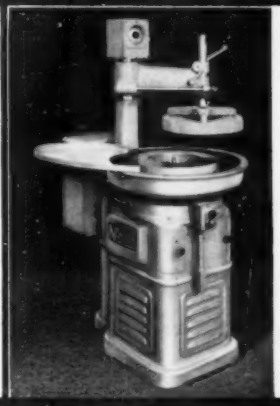


HYPROLAP LAPPING MACHINE #26. A high speed machine for two face flat lapping or cylindrical lapping that finishes up to 100 or more work pieces simultaneously. Lapping pressure is hydraulically powered and controlled — an exclusive Norton development. Arrangements: plain timed cycle; automatic continuous feed or semiautomatic continuous feed. Like other HYPROLAPS, lap truing is hydraulically powered and controlled.

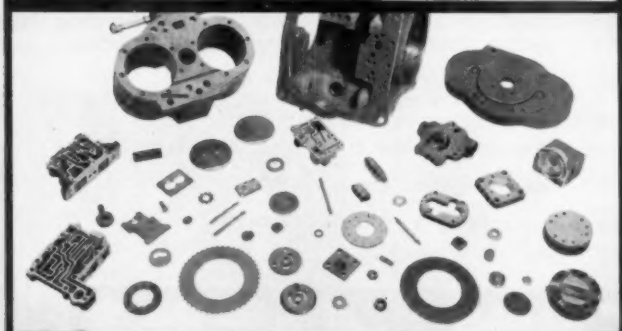


HYPROLAP LAPPING MACHINE #12-F. For small, parallel face flat lapping. Ideal for small ball bearings. Arrangements: plain timed cycle; automatic continuous feed or semiautomatic continuous feed. All three provide fast efficient lapping with selective speeds for laps and work-holders, permitting positive selection of ideal speeds for each job. Cleanliness of finished work surfaces eliminates the need for cleaning operations.

PLAIN TIMED CYCLE LAPPING MACHINE #28. Produces flat or cylindrical surfaces to extremely close tolerances and high degree of finish. Uses cast iron laps with loose abrasive. An attachment for cylindrical lapping is furnished with the regular flat lapping arrangement. For plug gage or gage block tolerances the machine is unsurpassed. An arrangement for hand lapping with 30", 36" or 40" cast iron laps is also available.



PLAIN TIMED CYCLE LAPPING MACHINE #16-FC. An outstanding performer for flat or cylindrical work, such as Diesel injector parts, plug gages, size blocks, sides of rings and short cylindrical parts. Using cast iron laps with loose abrasive it produces optically flat surfaces to extremely close thickness tolerances. Its fine repetitive accuracy helps reduce inspections and eliminates the need for selective assembly.



NORTON JOB LAPPING SERVICE. Improve your product quality by precision lapping. The Norton Job Lapping Department, complete and modern in every detail, is ready to finish jobs to your exact specifications. Flat or cylindrical lapping operations handled quickly to your tolerance specifications. Parallel face flat lapping is our specialty. See your Norton representative or write direct.

To Economize, Modernize with NEW

NORTON

GRINDERS and LAPPERS

Making better products... to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels
Grinding Machines • Refractories

BEHR-MANNING PRODUCTS: Coated Abrasives
Sharpening Stones • Behr-cat Tapes

*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries

District Offices: Worcester • Hartford • Cleveland • Chicago • Detroit — *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.

DESIGNED FOR THE MACHINIST'S TOOL BOX

Here's a catalog that exactly fits in a machinist's tool box in more ways than one. Not only are the Putnam Catalog physical dimensions exactly proportioned to fit within standard tool boxes so that it will always be handy, but, conveniently listed and illustrated within the Putnam Catalog are over 1400 different types and sizes of standard end mills.

Because at Putnam we specialize in the manufacture of end mills, you will find more standard sizes and types listed in this catalog than can be found in any other. Thus, on nearly every milling job you will find the quick and convenient answer to your end mill requirements right in your own tool box—in the Putnam Catalog.

If you would like a copy of this catalog, see your neighbor, the local Putnam distributor—this catalog is yours for the asking.

5360

PUTNAM TOOL COMPANY

2981 CHARLEVOIX AVENUE · DETROIT 7, MICHIGAN

Tool Steel Topics

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation

This die, made from Lustre-Die by Eagle Tool and Machine Co., Hillside, N. J., produces plastic part shown below.

Lustre-Die Tool Steel Fills Bill for Makers of Plastic Parts

So you're looking for high lustre! Just wait until you see the job you get when you use Lustre-Die, Bethlehem's new plastic-molding tool steel.

Lustre-Die is ideal tool steel for making plastic parts because it has properties which enable it to take such a high polish.

Sturdy and good looking, this plastic section for detergent can top was made from die of Lustre-Die.

One glance at Lustre-Die and you'll think you're looking in a mirror.

Lustre-Die is a special, electric-furnace steel of well-balanced analysis. It is alloy-fortified to increase its depth of hardenability and mechanical properties. It is also heat-treated by means of oil-quenching and tempering to a hardness of Brinell 302-352.

BASIC ANALYSIS

Carbon 0.50 Manganese 1.00 Silicon 0.30
Chromium 1.10 Molybdenum 0.25
(plus Alloy-Fortification)

Lustre-Die is such a clean, clean steel. It is carefully inspected to ensure freedom from porosity or surface pitting. Machining is easy, too, as the steel is free from nickel. Besides, there are no additives to cause inclusions, which could cause spotty areas on the die surface.

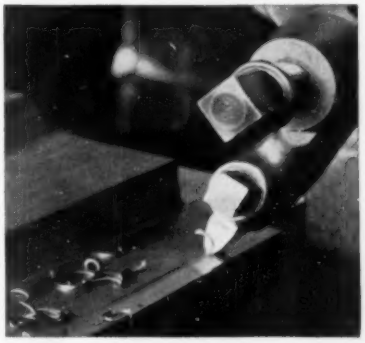
If you would like to purchase a trial piece of Lustre-Die, simply get in touch with your Bethlehem tool steel distributor.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Unusual Metal "Pickup" on Tools Is Caused By Carburization

Metal "pickup" occurring on the surface of tools used in shearing, blanking or forming metal can be an annoying problem. When such "pickup" is routine and expected, it is customary to provide continuous maintenance to remove the adhering metal. But when it suddenly occurs in an operation normally free from "pick-up," the trouble can be serious.

Recent investigations have shown that the most common cause of unusual "pick-up" on tools is the unsuspected presence of an unwanted carburized case, unintentionally placed on the tools during heat-treatment, and therefore not removed by grinding after heat-treatment. On many grades of tool steel, a high carbon case causes retained austenite to form during heat-treatment. As the austenite is very soft, its presence on the surface of otherwise hard tools is sufficient reason to account for metal "pickup." A regrinding operation on the tool usually removes the austenitic skin, eliminating the trouble.



GOOD RESULTS WITH 66 HS

Bethlehem 66 HS (High-Speed) tool bits can always be counted on for smooth, steady cutting. In the operation illustrated, the 66 HS bit is shaping a bending die. 66 HS, because of its well-rounded 6-5-4-2 analysis, has all the properties needed for economical high-speed work.

NELCO Brown & Sharpe
A Tremendous Tooling Team!

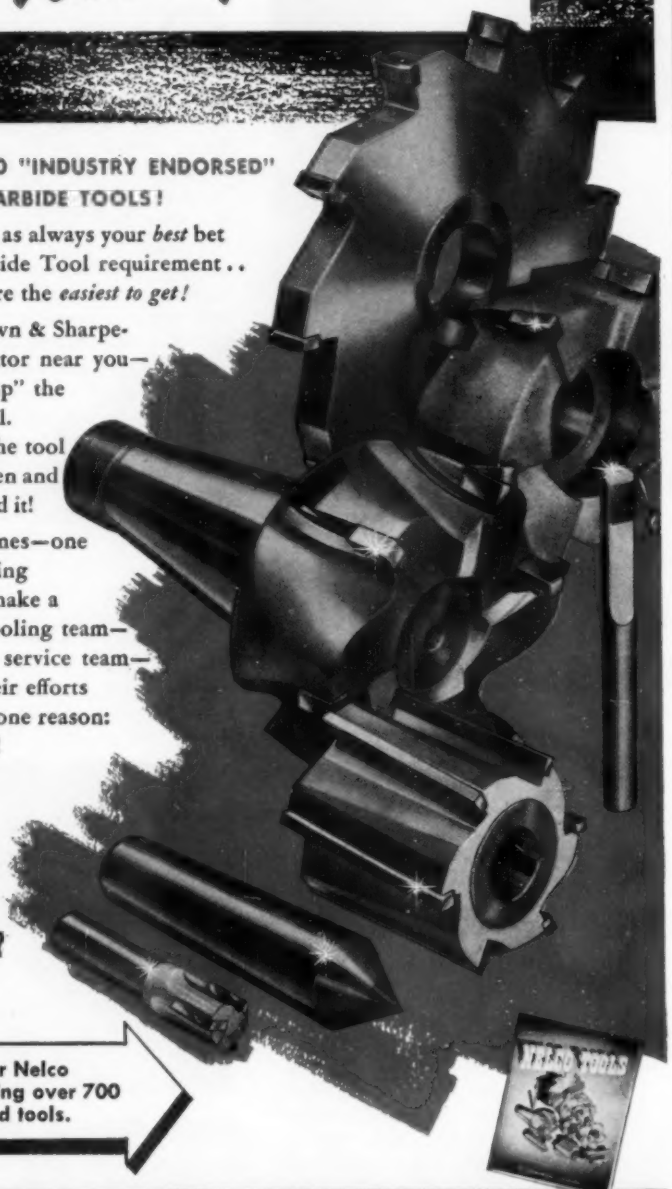
. . . OVER 700 "INDUSTRY ENDORSED" STANDARD CARBIDE TOOLS!

NELCO Tools as always your *best* bet for every Carbide Tool requirement . . and now they're the *easiest to get!*

There's a Brown & Sharpe-Nelco distributor near you—and he'll "jump" the minute you call. He'll deliver the tool you need—when and where you need it!

Two great names—one great distributing organization make a tremendous tooling team—a tremendous service team—combining their efforts and skills for one reason: to help YOU!

CALL YOUR NEAREST DISTRIBUTOR



Send today for Nelco catalog showing over 700 Carbide Tipped tools.

NELCO TOOLS

For that EXTRA Edge in Production!

NELCO TOOL COMPANY, INC. • MANCHESTER, CONNECTICUT

BROWN & SHARPE—NELCO COMBINE SALES ORGANIZATIONS!

A milestone in metalworking will be reached on September 1st, 1956, when Nelco Carbide Tipped Milling Cutters will become available through the Brown & Sharpe Sales Organization. Complete inventories of Brown & Sharpe—Nelco standard cutting tools will be maintained in every metalworking center, and dependable "milk route" delivery of any Nelco cataloged Carbide or Carbide Tipped Tool as well as any of the complete line of Brown & Sharpe High Speed Steel Cutting Tools and Accessories can be expected.

ANSWERS DEMANDS OF AMERICAN INDUSTRY

Recognition of the demanding production schedules of industries has made this complete sales cooperation expedient. Overnight delivery of the finest, proven tools available today is a service industry has a right to expect. New machine tools, expanded production commitments, pressure on delivery schedules, demands for reliable tooling have all pointed up the need for a single, dependable, complete tooling source.

NELCO "SPECIAL" TOOLS AT STANDARD PRICES

Carbide Tipped Face Mills, Slab Mills, Boring Bars, Special[illegible], Slitting Saws, Cutter A[illegible]-bide Tipped Side M[illegible]e Mills, Cutter A[illegible]yseat Cutters, Di[illegible], Shell End Mi[illegible]ace Mills, Grind[illegible] Centers, Tri-He[illegible] Cutters, Carbide Ti[illegible]lls, Solid Carbide E[illegible] Shell Milling Cutter Ar-bol[illegible] Forged Tools round out the Complete Nelco Line.

SALES, SERVICE, SATISFACTION *GUARANTEED!*

Two of America's foremost manufacturers, continually conscious of quality control, will now make the world's largest standard line of cutting tools for milling machines available to progressive metalworking plants both in the United States and through export channels. A standardization of quality tooling, both Carbide and High Speed Steel, will guarantee speedy service and nonpartisan sales recommendations with the right tools for the right application from a line of more than 3000 "standards!"

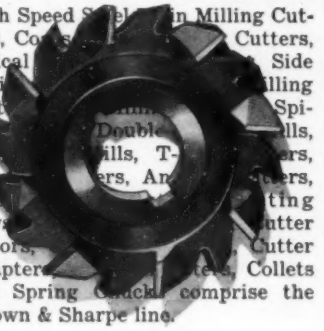
BROWN & SHARPE—NELCO PLEDGE QUICK SERVICE, GUARANTEED SATISFACTION

Over 3000 quality, expertly designed, engineered and "Industry Endorsed" Carbide, Carbide Tipped and High Speed Steel Cutting Tools will soon be available through the Brown & Sharpe—Nelco distributors. This represents the world's largest line of cutting tools and accessories, manufactured by two of America's most capable and respected manufacturers.

MODERN TOOLING, MODERN DISTRIBUTION!

Modern manufacturing methods, modern machine tools, increased production requirements demand improved tooling service. Brown & Sharpe and Nelco now make the most complete line of the best in cutting tools available to progressive manufacturers everywhere, faster than ever before.

WORLD'S MOST COMPLETE LINE OF CUTTING TOOLS & ACCESSORIES



High Speed Steel ... Milling Cutters, Co... Cutters, Helical ... Side Milli... ...lling Cutt... Spi-ral... ...Double... ...ills, She... T-... ...ers, Ke... ...ers, An... ...ers, Scre... ...tting Saw... ...utter Arbors, ... Cutter Adapters, ... Collets and Spring Chucks comprise the Brown & Sharpe line.

SPECIALS, A SPECIALTY

Nation-wide distribution and tremendous production capacity guarantee expert attention and prompt delivery for all special cutting tool applications.

TREMENDOUS TOOLING TEAM

Remember: the best in cutter tooling is Brown & Sharpe and Nelco. The easiest and quickest to buy is Brown & Sharpe and Nelco. Remember this tremendous tooling team.

CATALOGS AND PHONE ALL THAT IS NECESSARY

One Brown & Sharpe Cutter catalog, one Nelco catalog and a phone are all that is needed to solve every cutting tool problem. Over 3000 of America's finest cutting tools are at your fingertips, saving anxiety—days of waiting—dollars of extra cost.

Brown & Sharpe NELCO *A Tremendous Tooling Team!*

OVER 2300 "INDUSTRY ENDORSED" STANDARD HIGH SPEED STEEL CUTTING TOOLS AND ACCESSORIES!

For the first time, a modern manufacturer with 123 years of metal-working experience is anxious to answer ALL your cutter problems! A total of over 3000 Solid Carbide, Carbide Tipped and High Speed Steel Cutting Tools are as near as your phone.

Call your Brown & Sharpe-Nelco distributor now! Find out how speedily two great names—one great distributing organization—can solve all your "Standard" and "Special" tooling problems. You'll be glad you did—you'll save days and dollars!

BUY THROUGH YOUR LOCAL DISTRIBUTOR!

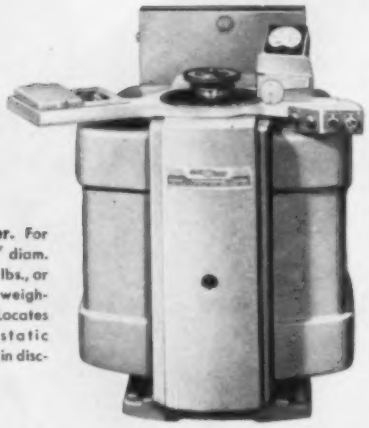
Send for Brown & Sharpe Catalog showing over 2300 High Speed Steel Tools and Accessories

B·S

Brown & Sharpe

BROWN & SHARPE MFG. CO. • PROVIDENCE 1, RHODE ISLAND

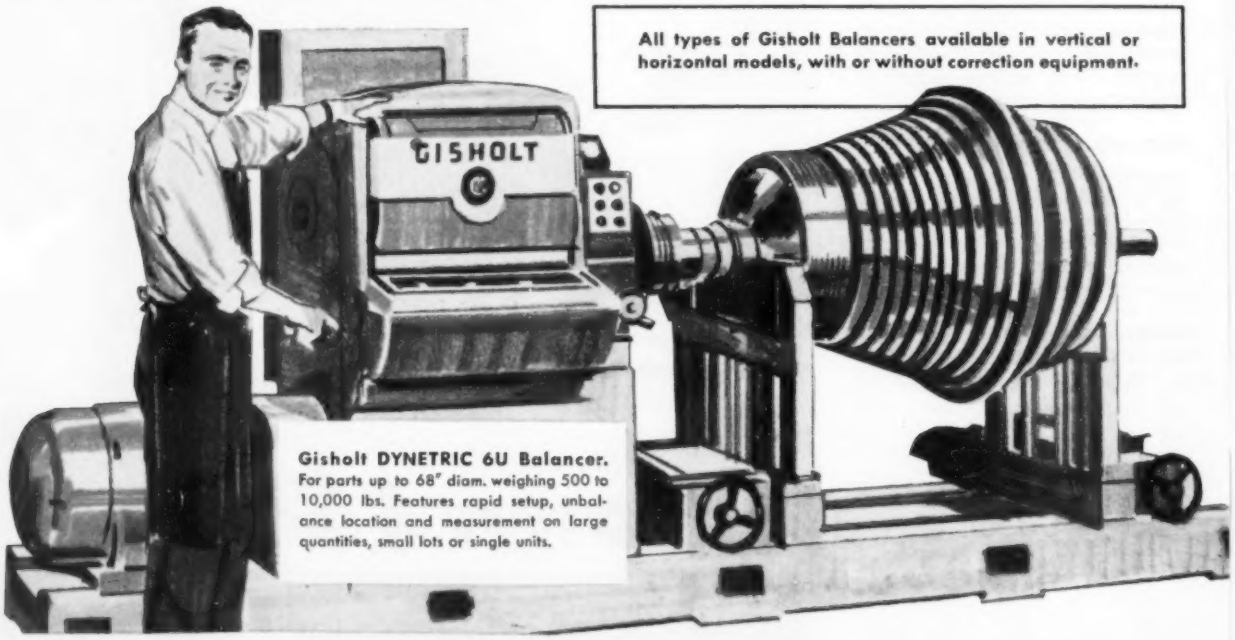
GISHOLT takes the ...cuts time



Gisholt 1SV1 Balancer. For parts up to 11½" diam. weighing 1 to 15 lbs., or up to 17½" diam. weighing 2 to 50 lbs. Locates and measures static (force) unbalance in disc-like parts.

Gisholt OSB Bench Balancer. For parts up to 6" diam. weighing 0.25 to 5 lbs. Small parts readily handled, with location and amount of unbalance in each of two selected planes accurately determined in 15 seconds or less.

All types of Gisholt Balancers available in vertical or horizontal models, with or without correction equipment.

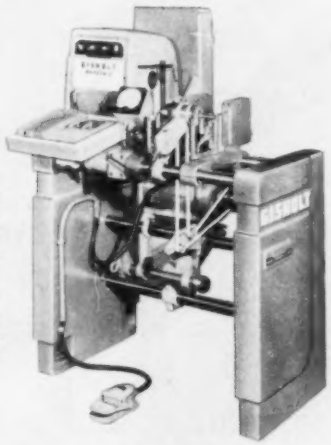


Gisholt DYNETRIC 6U Balancer. For parts up to 68" diam. weighing 500 to 10,000 lbs. Features rapid setup, unbalance location and measurement on large quantities, small lots or single units.

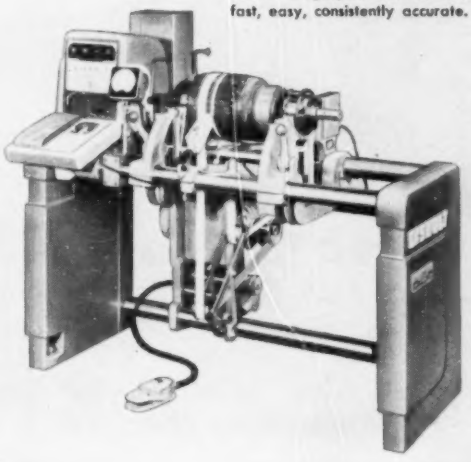
guesswork out of balancing and costs, too!

MASTERLINE GISHOLT SINCE 1887

Gisholt 1S Balancer. For parts up to 12" diam. weighing 1 to 30 lbs. Locates and measures either force or moment unbalance effects, indicating amount of correction in units most practical for part.



Gisholt 3S Balancer. For parts up to 24" diam. weighing 15 to 300 lbs. Gisholt Balancers eliminate charts and graphs, make balancing fast, easy, consistently accurate.



IN A MATTER OF SECONDS, a Gisholt Balancer locates and measures vibratory movements in either one or two planes (force or moment), and tells your operator precisely where and how much correction to make to balance the part.

By simply reading the Amount Meter, he knows instantly how much solder or how many washers to add, or how deep to drill, etc. There is no computation, no charts or graphs because Gisholt Balancers tell the story directly—and they tell it in terms of the actual correction method employed.

How is it done? Through electrical networks, providing the necessary amplification for precise readings... and eliminating guesswork by separating and isolating unbalance effects, for maximum accuracy and ease of correction on all types of work.

What will Gisholt Balancing mean in your own operations? Just this: you'll balance more parts per hour—to highest possible standards at lowest possible costs.

Whether you plan to balance parts weighing only a few ounces to 150 tons...your Gisholt Representative can show you the better way of doing it with Gisholt Balancers. Call him today!

DYNETRIC BALANCERS GISHOLT

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin, U.S.A.

WRITE TODAY for 36-page illustrated booklet "Balancing Machines," analyzing problems of balancing rotating parts.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • PACKAGING MACHINES • MOLDED FIBERGLAS PLASTICS

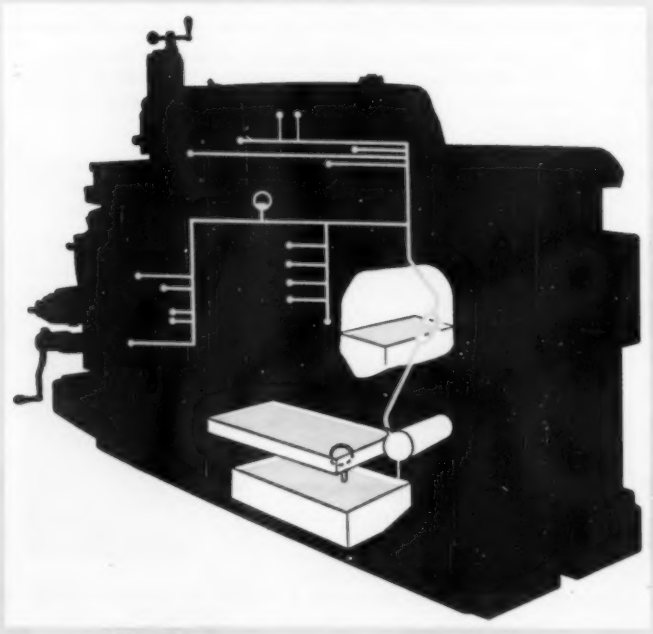
50 lbs. oil pressure

IS NECESSARY WITH A CUT LIKE THIS...

Demonstration cut on Cincinnati Rigid Shaper.
Actual size steel chip, 2" cut, .030" feed.

This tremendous cut demonstrates the ability of the 50 p.s.i. lubrication system to develop and maintain oil films under the heaviest loads.

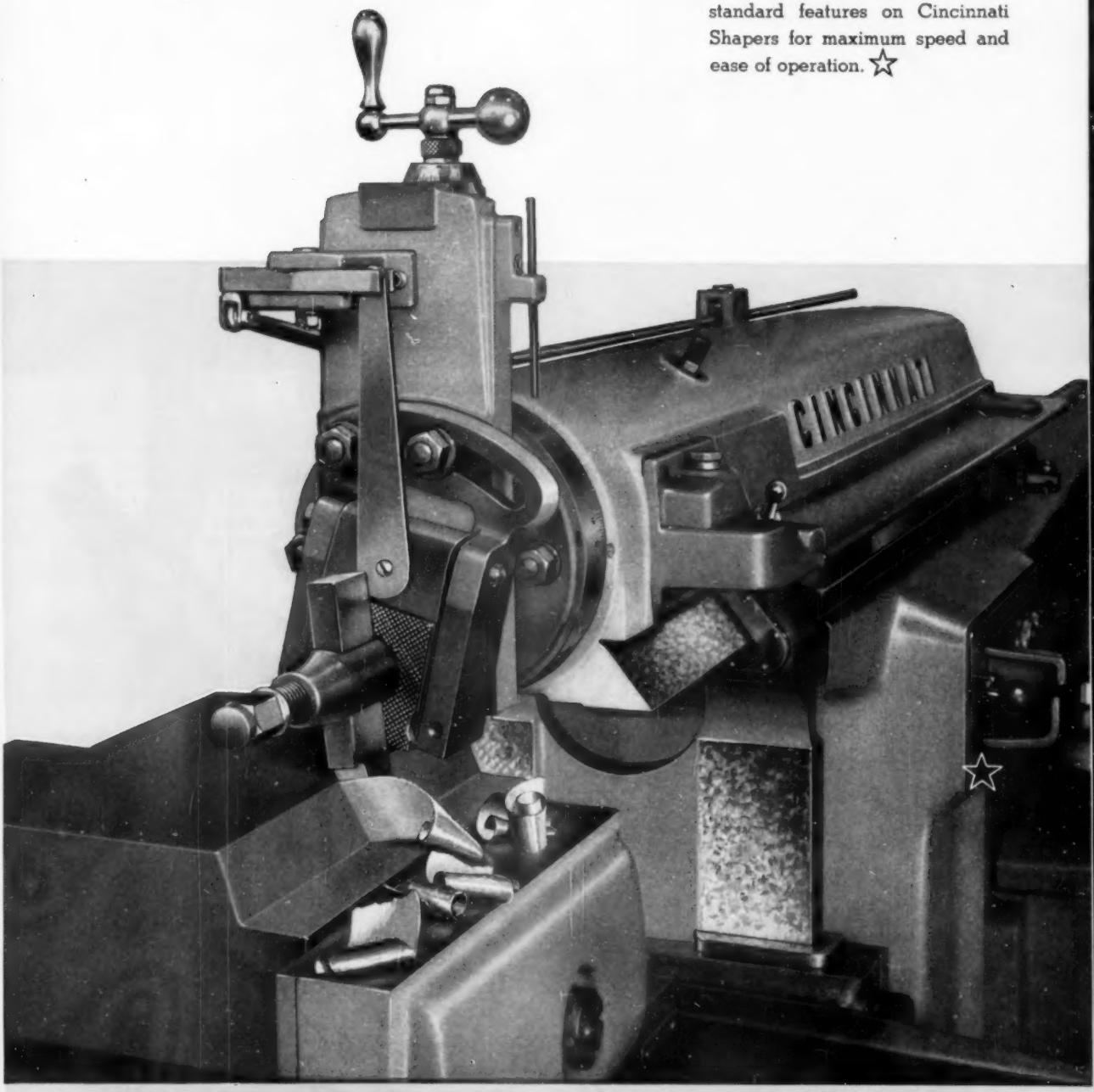
It also demonstrates the strength, rigidity and power which are standard features on all Cincinnati Rigid Shapers.



Write for Bulletin "Cincinnati Rigid Shapers"

50 p.s.i. system includes 50 micro filter, settling basin and reservoir. Transmission runs submerged in oil.

The Electro-Magnetic Brake and Clutch with finger tip control are standard features on Cincinnati Shapers for maximum speed and ease of operation. ☆



THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

CINCINNATI

*Controlled Measure

There's something majestic about a bridge. We often view it in its entirety . . . without appreciating the many components that contribute toward its strength as a unit.

Yet — even in such a huge structure . . . controlled measure is important.

Precision and balance of parts are carefully engineered for stress and strain. Each part must fit in ratio, as accurately as the intricate pieces of a delicate instrument.

Bath cylindrical plug or thread, ring or reversible type gages, guarantee controlled measure of component parts on the inspection line.

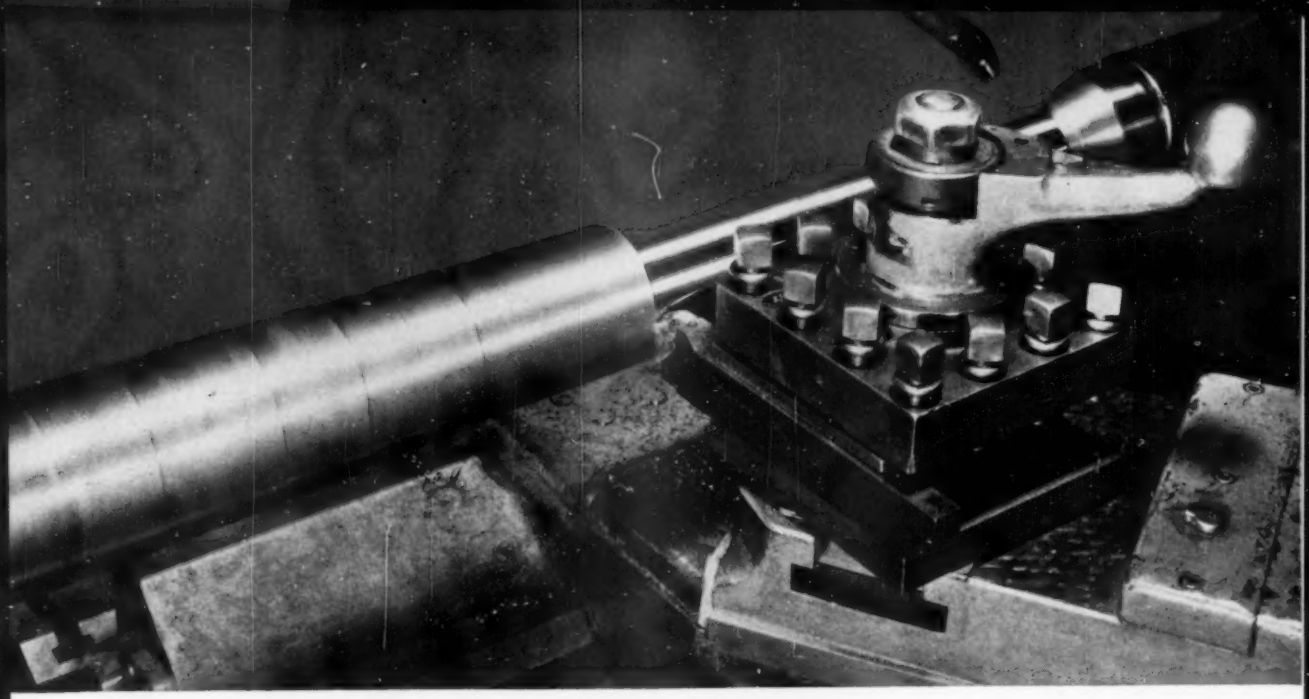
Made for dependable service and long wear-life . . . Bath gages are your best buy for reliable check of threaded and plain parts.

JOHN BATH & CO. Inc.
28 Grafton St., Worcester, Mass.

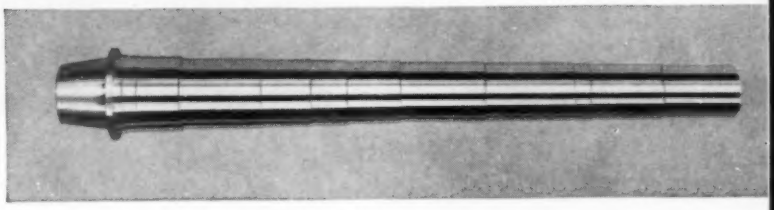
CYLINDRICAL AND THREAD GAGES • GROUND THREAD TAPS
INTERNAL MICROMETERS

When you buy Bath Gages . . .
you buy controlled measure!

for the best buy
. . . buy Bath



Carboloy Cemented Oxide finishes 31-inch lathe spindles in 2.8 minutes at R. K. LeBlond Machine Tool Co. Carbide tool used previously required 6 minutes. With the Cemented Oxide tool, the 12-step cut is made at 715 fpm – more than double the speed with carbide. Work finish is improved, and machine output is increased 45% per grind.



Takes up where carbides leave off...

FINISH STEEL WITH CARBOLOY CEMENTED OXIDE; GET FINER FINISHES AT HIGHER MACHINE SPEED

With new Carboloy® Cemented Oxide, you can finish steel faster than ever before possible. Specially developed for machining at speeds beyond the range of carbides, Cemented Oxide produces superior surface finishes, while reducing your machining costs.

Cuts faster, wears longer

Field and laboratory tests show Carboloy Cemented Oxide can be used effectively at speeds from 300 to 7500 fpm, on steels up to 300 Brinell. It cuts cleanly, resists edge wear and cratering at surface speeds which would quickly ruin other cutting materials.

Carboloy Cemented Oxide brings you two major advantages: It lets you cut faster – and therefore more efficiently – with your present equipment; it reduces the time required to complete a job. And, its unusual wear-resistance at these high speeds means less downtime for tool changes, lower tool and grinding costs.

Resists chipping, stays cool

Cemented Oxide is an entirely new kind of cutting material. It is harder than carbide, stronger and more resistant to chipping than typical ceramics. Even at extremely high operating speeds, the tip stays so cool it can be touched immediately after the cut.

With Cemented Oxide Grade 0-30 and the three Carboloy extra-performance carbide grades, you now have a specialized cutting material available for every steel-cutting job from roughing to super high-speed finishing. Limited quantities of Cemented Oxide Grade 0-30 are ready for evaluation on your finishing jobs. For information or technical bulletin, send the coupon on page 4 of this advertisement.

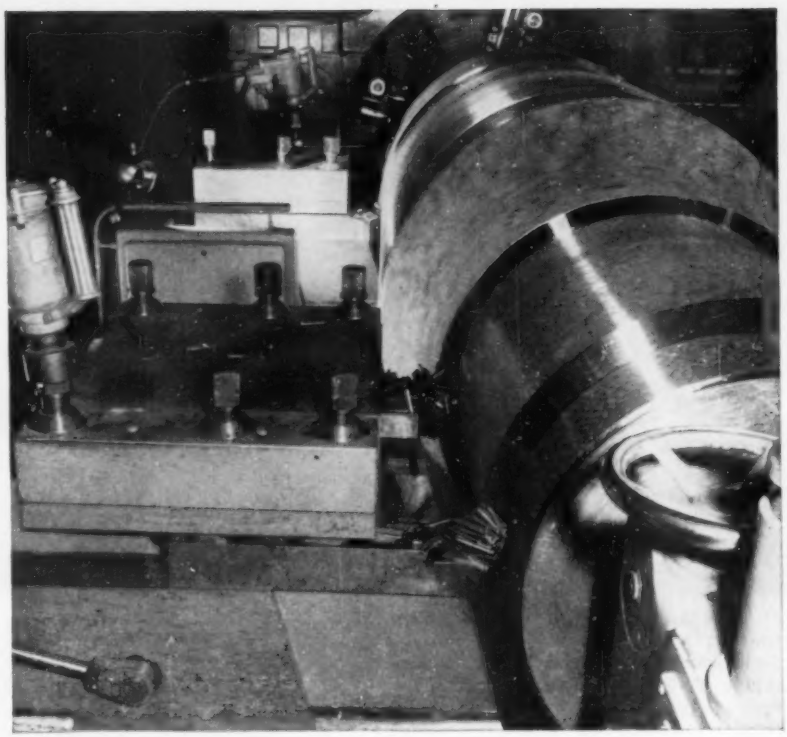
CARBOLOY
CEMENTED OXIDE

GRADE 370

EXTRA-PERFORMANCE CARBIDE FOR HEAVY-DUTY ROUGHING

Grade 370 is built to take heavier roughing cuts at higher speeds and feeds . . . yet outlast conventional carbides. Hundreds of in-plant tests have proved Grade 370 will remove more metal per minute – and take more regrinds – than any other grade.

For example, on huge steel backup rolls like the 31-ton roll at right, a single Grade 370 insert has removed 24,000 cubic inches in 2½ hours . . . without regrinding. Cutting through rough scale and hard seams, Carboloy Grade 370 tools will finish this job in 16½ hours.



For every job from roughing to finishing . . .

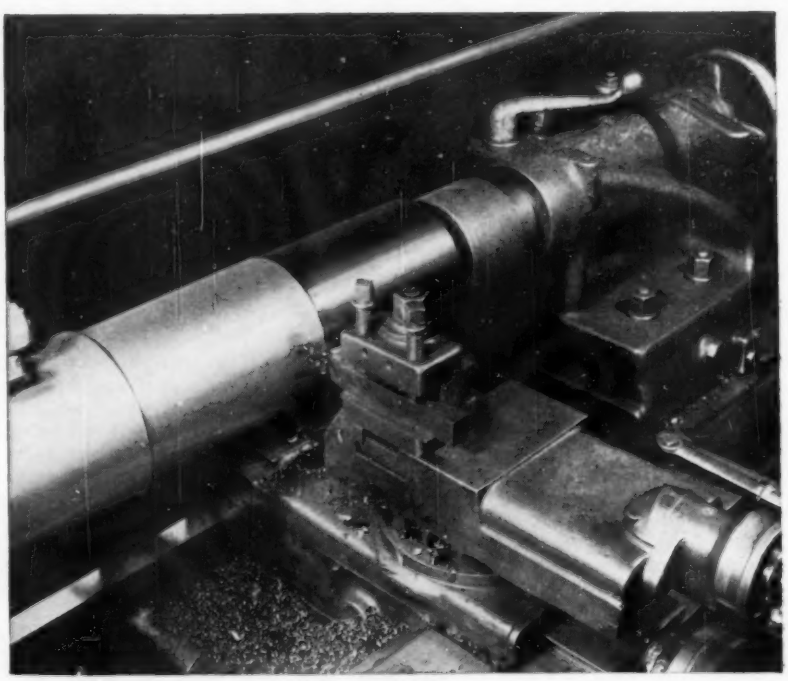
CUT STEEL FASTER, LOWER TOOL COSTS WITH

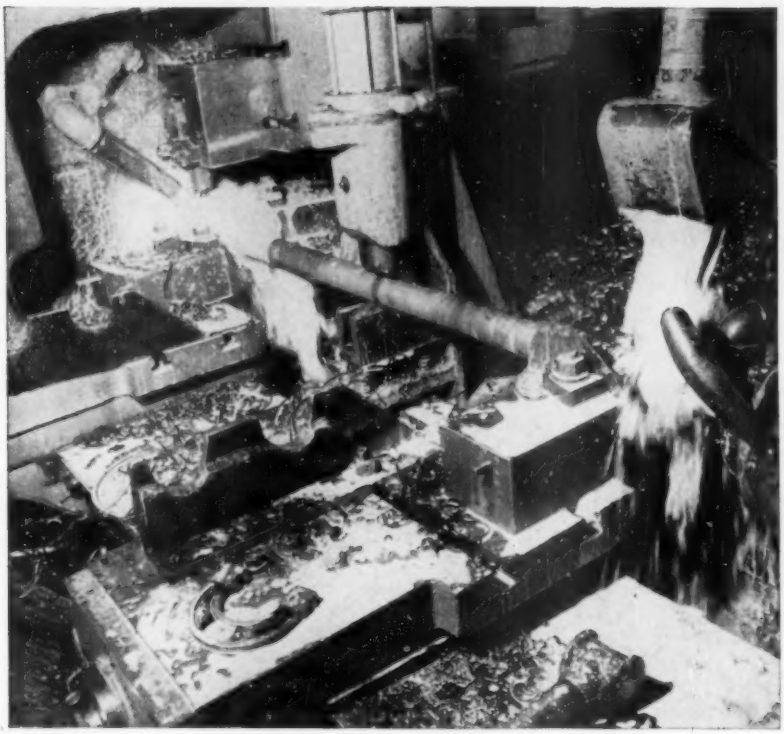
GRADE 330

EXTRA-PERFORMANCE CARBIDE FOR FINISHING AND BORING

New Carboloy Grade 330 is twice as strong as conventional steel-finishing grades. Its entirely new composition makes 330 easier to braze, yet more resistant to chipping. Unlike other finishing grades, Grade 330 is so tough it can be ground on automatic grinders without cracking.

Grade 330 can take speeds 10% higher than other carbides, without loss of tool life. When compared at a series of speeds ranging from 600 to 1900 fpm, Grade 330 outlasted other grades by 20%-35%. (Picture at right shows surface finish obtained on S.A.E. 1045 steel at 800 FPM.)





GRADE 350

EXTRA-PERFORMANCE CARBIDE FOR MEDIUM-DUTY MACHINING

Grade 350 was specially developed to increase your machines' efficiency in the light roughing and general finishing range. Built-in structural rigidity enables Grade 350 to withstand steel-cutting conditions which quickly cause tip deformation in ordinary carbides. Its extra strength gives you more production per grind, more grinds per tool.

For example, in machining the AISI 4150 truck axle forging at right, Grade 350 boosted production 33%. In addition, Grade 350 eliminated chipping and flaking encountered with other carbides.

CARBOLOY EXTRA-PERFORMANCE CARBIDES

- **Take heavier, deeper cuts with Grades 330, 350, 370**
- **Get increased production from machines and manpower**

Announcement of new Grade 330 means you now have a choice of *three* Carboloy extra-performance steel-cutting carbides.

New Grade 330 takes up on finishing and boring jobs where medium-duty Grade 350 leaves off. And together with heavy-duty Grade 370, these carbides offer you faster cutting at lower cost over the complete steel-cutting range from roughing to finishing.

Outperform conventional carbides

Service-proved on thousands of applications like the ones above, these grades consistently outperform conventional carbides. Even at higher speeds and feeds, they take heavier, deeper cuts . . . yet outwear other grades.

Their superior strength means more production per hour, greater output per machine. Their resistance to wear means less downtime, fewer wasted man-hours for tool changes, and lower tool costs.

Complete line stocked locally

All three of these extra-performance carbides are stocked locally by your Authorized Carboloy Distributor. They are available in a complete line of standard tools and blanks, as well as inserts for your toolholders.

Try these extra-performance carbides in your plant . . . and see why there is no such thing as an "equivalent grade" for Carboloy 330, 350, and 370. For more information, see your Carboloy Distributor, or mail the coupon on page 4 of this advertisement.

CARBOLOY
CEMENTED CARBIDES

CUT MACHINING COSTS, SAVE SETUP TIME WITH CARBOLOY MACHINABILITY COMPUTER

- ▶ **Determine most efficient cutting conditions in seconds**
- ▶ **Eliminate wasteful tryout runs, save valuable stock**
- ▶ **Get closer control over inventories and production schedules**

How the Machinability Computer is helping Scully-Jones and Co.

Original operating standard for machining expanding shells called for 244 minutes per part. But by calculating the optimum combination of speeds, feeds, and other data on the Computer, the company saved 77.8 minutes per part. Machining time was cut 32% . . . 17 machining hours were saved on a 13-piece run. Scully-Jones used the Computer to determine correct setups for both HSS and carbide tools—on turning, facing, drilling, and boring jobs.

Scully-Jones and Co., Chicago, is just one of hundreds of plants now getting greater production from their machines by using the Carboloy Machinability Computer.

Machining data are fed into the Computer . . . and in seconds, optimum speeds, feeds, horsepower ratings, or any of 16 other operating variables are accurately figured for the machinist.

On the job above, for example, the Computer showed how to cut machining time 32% on a 13-piece run . . . saving 17 machining hours and eliminating wasteful tryout runs.

Benefits extend plant-wide

On other jobs throughout the plant, the Computer establishes new operating standards, corrects and verifies existing ones . . . in a fraction of the time previously required.

In addition, the Computer simplifies inventory problems by predicting rate of tool wear. It aids grinding rooms plan work loads; helps management coordinate production schedules. The Computer is a versatile engineering tool for any sized plant.

Ask for demonstration

Price of the Carboloy Machinability Computer is $495, f.o.b. factory, Detroit. It is battery-operated, portable, and rugged; can be used by anyone with machining experience after a short familiarization period.

For more information on how the Computer can help your plant increase production and reduce manpower costs, mail the coupon below. If you wish, we will gladly arrange a demonstration in your plant.

CARBOLOY
MACHINABILITY COMPUTER

Metallurgical Products Department
General Electric Company
11101 E. 8 Mile Street, Detroit 32, Mich.

Send me information on the following products:

- ☐ Carboloy Cemented Oxide Grade 0-30
- ☐ Steel-Cutting Grades 330, 350, and 370
- ☐ Carboloy Machinability Computer
- ☐ Have a representative make an appointment to demonstrate the Computer

Name_____

Title_____

Company_____

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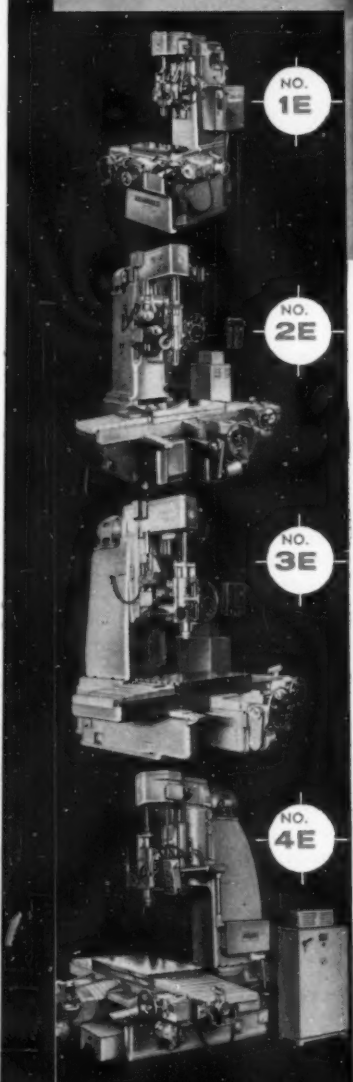
City_____ Zone_____ State_____

Carboloy is a trademark of General Electric Company

Get to the POINT... *in a hurry!*



with

PRATT & WHITNEY *Electrolimit* JIG BORERS

The point we'd like to make is that Pratt & Whitney Electrolimit Jig Borers incorporate an exclusive method of locating the table that is *unbeatably* fast and convenient . . . and accurate to .0001".
Thanks to the P&W Precision Preloaded Ball Roll Quill, you'll be able to retain original accuracy and rigidity *indefinitely* without any adjustment or maintenance.
And there'll never be any loss of accuracy from wear.

NOW . . . Pratt & Whitney Electrolimit Jig Borers can also be furnished with positioning control by NUMERICAL DATA.

. . . COMPLETE LINE includes table sizes from 12"x24" to 36"x72".

Write for free copy of P&W Electrolimit Jig Borer Circular No. 587 . . .

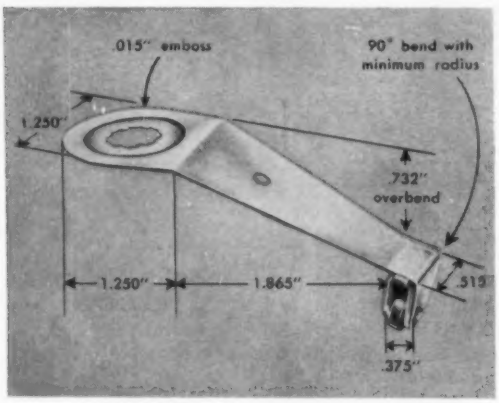
ALSO FURNISHED . . . a full line of Pratt & Whitney End Measure Jig Borers which also deliver "tenths" accuracy year after year.

PRATT & WHITNEY COMPANY
INCORPORATED
16 Charter Oak Boulevard, West Hartford, Connecticut
Representatives in Principal Cities Throughout The Country

MACHINE TOOLS · GAGES · CUTTING TOOLS

This railroad runs better, will last longer

A Type ZW Lionel Trainmaster Control has four independent variable voltage circuits, can operate four trains simultaneously.



One of the four variable voltage taps in a Type ZW Lionel Trainmaster Control, now made of .0150" thick Duraflex in spring temper. This temper in Duraflex provides the extra strength needed—with the same forming properties as conventional phosphor bronze in extra hard temper.

Lionel switched to DURAFLEX for the hardest working parts of its Trainmaster controls

Much of the fun of model railroading depends on the smooth, dependable performance of its controls. That's why Lionel makes its Trainmaster controls tough, precision instruments—constantly guards their quality.

Lionel had been using an ordinary phosphor bronze in the vital, hard-working variable voltage taps. But they were troubled with fractures in forming the bends. To maintain their quality standards, they considered using another alloy, at substantially increased cost.

First, however, they tried Duraflex*, Anaconda's new superfine-grain phosphor bronze. The fractures were eliminated. The press room found the forming qualities of Duraflex excellent. The Transformer Department was pleased with the reduction in rejects, found the strength and resilience better.

So Lionel has controls of superior quality—at no extra cost—for Duraflex costs no more than ordinary phosphor bronze.

Duraflex, because of its superfine-grain structure, offers greatly improved fatigue resistance and formability. It also has a finer, smoother, harder surface, plus good electrical conducting properties and high corrosion resistance. It is produced in sheet metal up to 0.062" thick and in wire up to 3/16" diameter. We will provide free samples for test purposes—specify gage and temper. Write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 5006

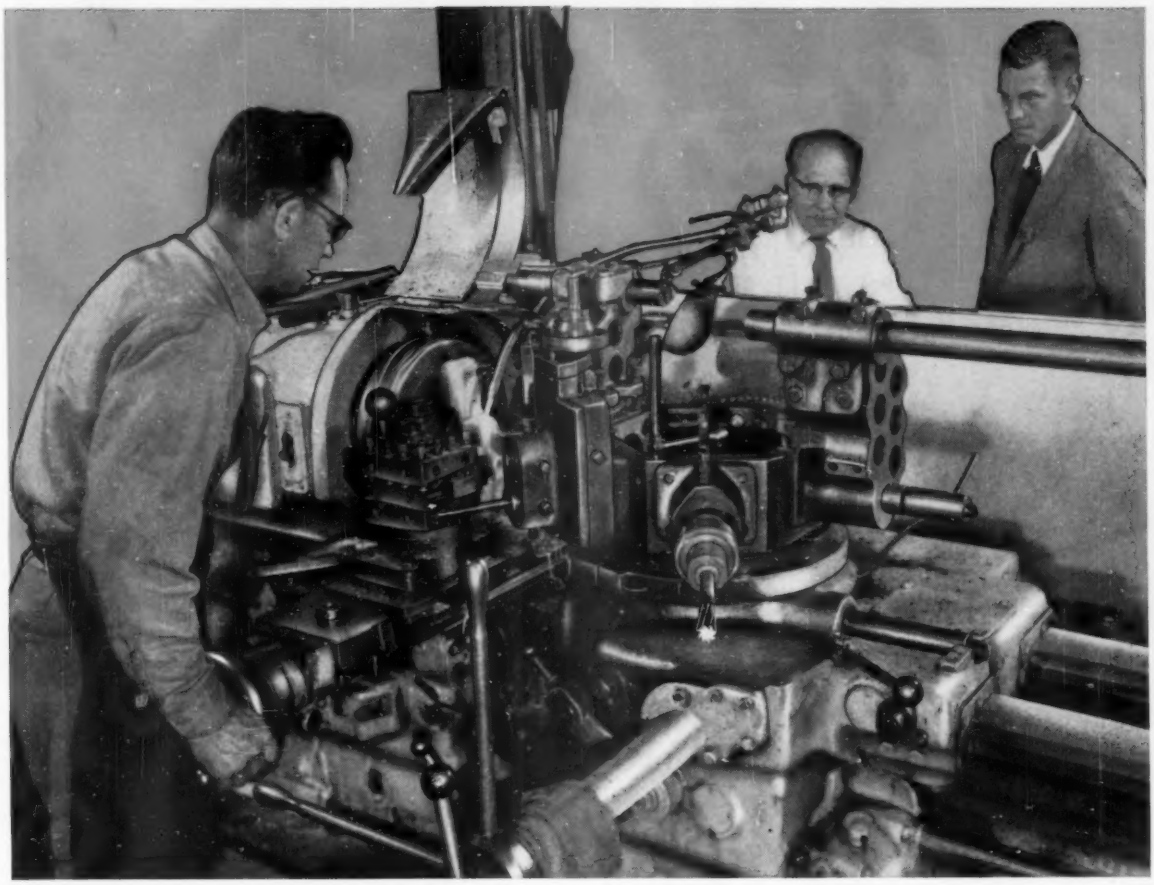
*Trade Mark

DURAFLEX

The New Superfine-Grain Phosphor Bronze

with 30% Greater Endurance Limit

an ANACONDA® product



Shop Superintendent Bonnafe and Gulf Sales Engineer G. R. Burnham check on performance of Gulfcut 51A as turret lathe turns a stainless steel drive roll for a wire belt.

"Gulfcut gives us longer tool life,"

says Joseph Bonnafe, Shop Superintendent, J. W. Greer Company, Wilmington, Mass.

Shop superintendents like Mr. Bonnafe, engineers and machine tool operators *know* that production can be improved and costs lowered through the use of cutting oils designed specifically for the job. And, they know they can get the right oil for *every* job from the complete line of Gulfcut Oils. Reports like these come from the field every day:

From an aluminum plant: ". . . stepped up production of aluminum caps 25%, increased tool life well over 100%, and we're getting better threads."

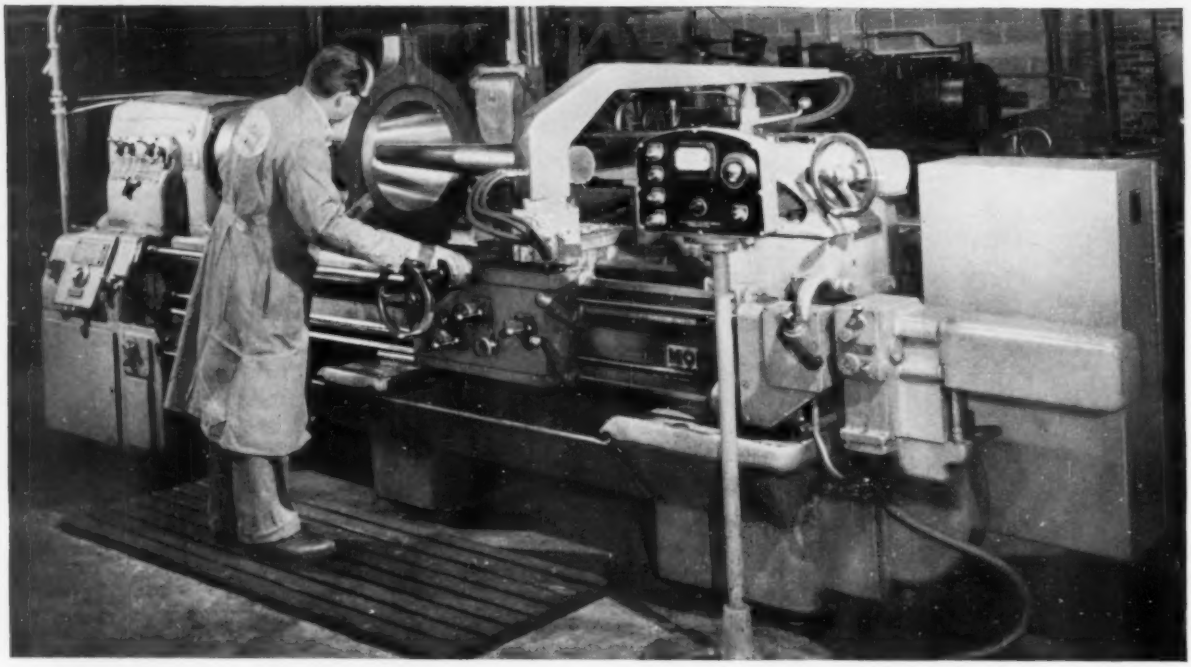
From a plant working tough titanium-alloy stainless steels: ". . . results were phenomenal. Tool life increased over 40% and surface finish was improved 43 microns."

Your Gulf Sales Engineer can pin-point your cutting oil requirements—can help you improve shop efficiency through the use of the most suitable cutting oils for your needs. Contact him today at your nearest Gulf Office.

GULF OIL CORPORATION
GULF REFINING COMPANY
1822 Gulf Building
Pittsburgh 30, Pennsylvania

GULF

THE FINEST PETROLEUM PRODUCTS FOR ALL YOUR NEEDS



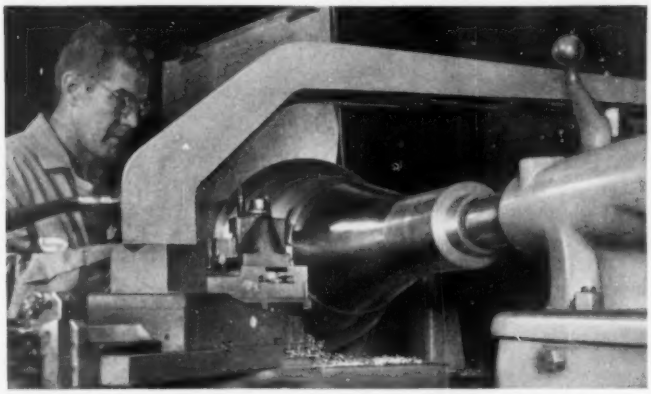
A Monarch 20″ Series 61 Swiveling "Air-Gage Tracer" Lathe contour boring a jet cone to a depth of 31½″. The I. D. starts at approximately 18½″ and decreases to approximately 4″. The contour of the I. D. has a radius and blend tapers. Material is the tough super-alloy called A-286, one of the toughest of all the new super-alloys to machine. "Some jobs", says Diversey's president, "can only be done on Monarch swiveling-type tracer lathes".

Hitch up the talents of DIVERSEY ENGINEERING COMPANY, Franklin Park, Illinois and their tracer-controlled Monarch lathes, and you get one of the most important production teams in our jet engine and guided missile programs.

Starting with one Monarch lathe seven years ago, Diversey is now the largest in the country specializing in these components. Fifteen lathes—an exclusively Monarch installation—are now in practically around-the-clock use. All but two are tracer-controlled. Latest is a 48″ swing swiveling Air-Gage Tracer type machine, the capacity of which places Diversey in the position of being one of the few companies in the United States with the equipment and know-how to handle machining on some of the large, new guided missile contoured parts.

Monarch's tracer controlled lathes are more than the Secret Weapon's secret weapon—they're everybody's weapon for better production. Yours too! Ask for Booklet #2608 —or a sales engineer . . . **The Monarch Machine Tool Company, Sidney, Ohio.**

The same Series 61 turns the same jet cone, described on opposite page. This operation uses practically the full swing capacity of the lathe.



"GUIDED" LATHES for Guided Missiles

Contour Turning of "Super-alloys" Made Easy

A Monarch 20" Model M "Air-Gage Tracer" Lathe finish machines the center bulkhead of a guided missile to 63RMS. Material is heat-treated hi-nickel alloy. In the foreground of above illustration is a number of completed bulkheads while toward the tail end of the machine are some nose cones for a missile head. These are also turned on the 20" Model M. Smaller view (above right) shows clearly the unusual finish imparted.

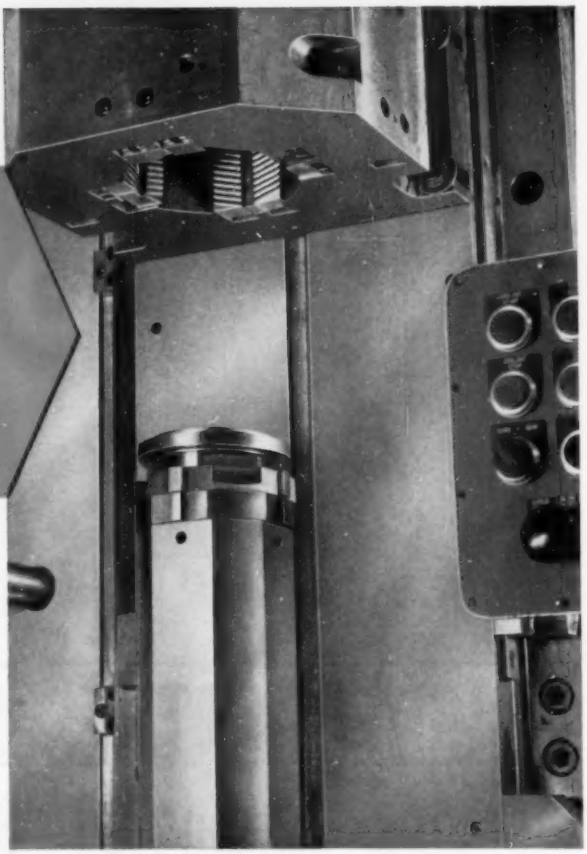
Monarch
TURNING MACHINES
ACCURACY • ECONOMY • LONG LIFE

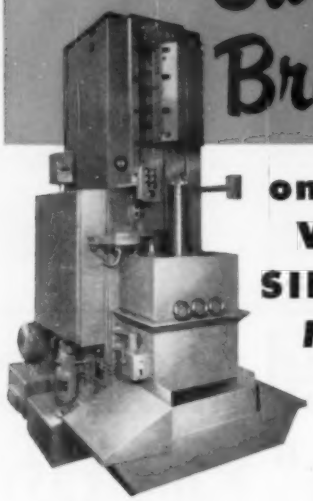
FOR A BETTER TURN FASTER
. . . TURN TO MONARCH

UNUSUAL TOOLING SETUP FOR

External Surface Broaching

on DETROIT VERTICAL SINGLE RAM MACHINE





This broaching job requires rigidity and perfect alignment . . . which makes it a "natural" for the massive Detroit Vertical, built and tooled by experts. Note the safety feature which prevents the main slide from descending until dual push buttons have been operated. This slide holds the heavy, pot-type broach holder in perfect alignment with the fixture post, which is mounted on a fixed knee for even greater accuracy.

Detroit Vertical Single Ram machines are available in standard capacities from 5 to 25 tons, stroke length from 30″ to 90″. Interchangeable knees with shuttle table mechanism can readily convert this machine into a standard for future production needs. Oversize platens on all standard models allow multiple as well as single station tooling.

Detroit builds every size and type of broaching machine, automates and tools them to fit your needs. Call in a Detroit field engineer, or send us details of your production problem . . . today.

PART—Automotive transmission component.

OPERATION—Broach 4 external lugs, equally spaced.

TOOLING—Pot-type broach holder, built in sections for convenient tool assembly . . . in perfect alignment with fixture post.

CYCLE—Operator loads work over fixture on top of post, starts machine. Broach holder descends with ram and bottoms after cutting stroke. Operator unloads work and presses palm button for return stroke.

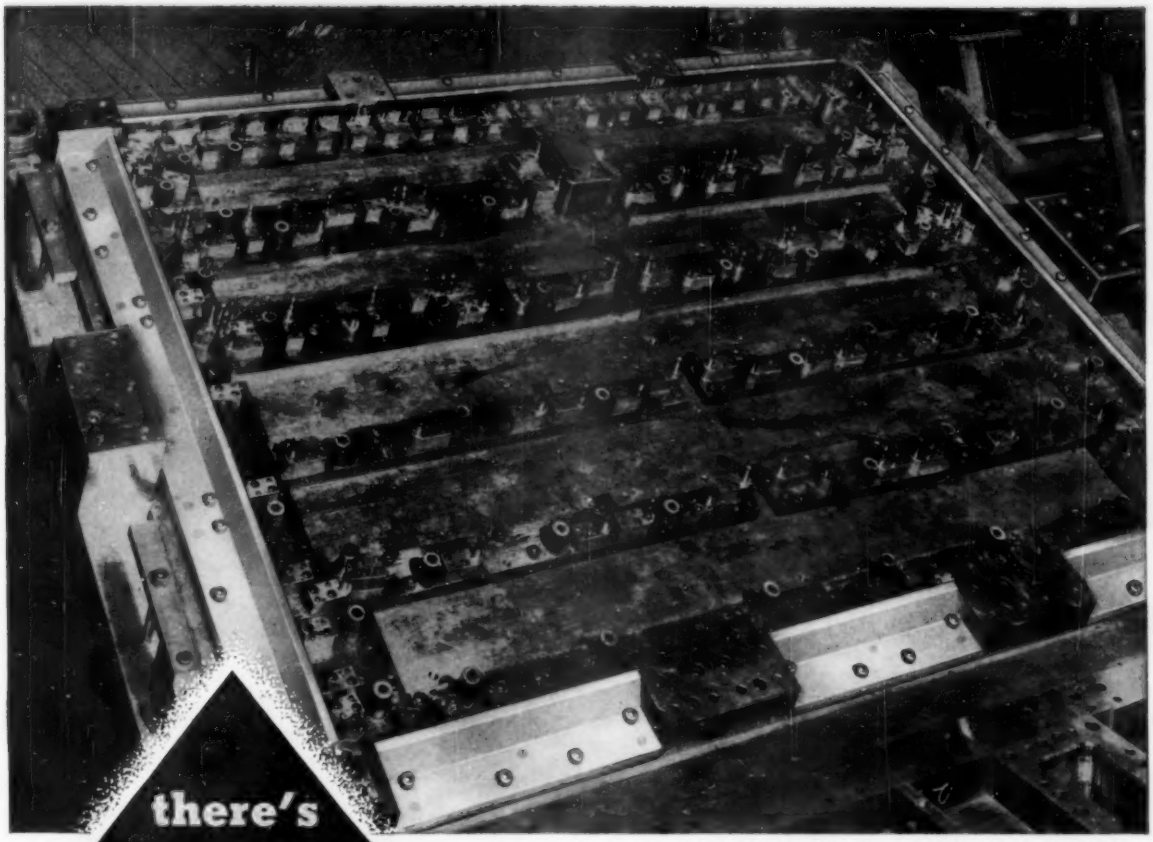
PRODUCTION—120 parts per hour.

MACHINE—Detroit 10-ton Vertical Single Ram Broaching Machine with 42″ stroke and fixed knee.

Write for new free bulletin on Detroit Vertical Single Ram Machine

DETROIT BROACH & MACHINE COMPANY

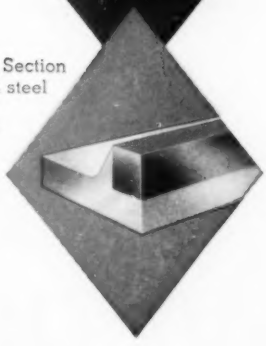
DEPARTMENT D-12
ROCHESTER, MICHIGAN



Photograph courtesy of the Ready Machine Tool & Die Company, Inc., Connersville, Ind. shows Ohio Knife Co. Composite Die Sections on a blank and pierce die for a 4' x 6' refrigerator inner food compartment.

there's a NEW way to build your dies

it saves you time and money



OK Die Section shows tool steel clad to mild steel backing.

You simply order from our large stock of Composite Die Sections. They are cut to your required length or in bars 125" long. There are eleven standard cross sections with both wide and narrow lands available.

You buy them at a price far below what it's costing you to make them yourself.

You receive them with cutting or forming edge already hardened, machined and ground. The soft steel backing, to which our specially hardened tool steel is clad, can be drilled quickly and economically for dowel and screw holes. Adjustments for wear are equally simple.

Hundreds of companies who have switched to OK Composite Die Sections available for Cutting, Trimming and Forming Dies, report great time and money savings, plus longer die life. For new bulletin on OK Composite Die Sections and Clad Aluminum Bronze Wear Plates, write Dept. 47-U.

Manufacturers
for the Metal Working Industry of:

Composite Die Sections . Bronze Ways . Wear Strips
Shear Blades . Slitter Knives . Work-Rest Blades
Cut-off Blades . Hardened Ways . Hardened Spacers

THE OHIO KNIFE CO.

CINCINNATI 23, OHIO

0A

9" column 3'-4' arms

1A

9"-11" column 3'-4'-5' arms

3A

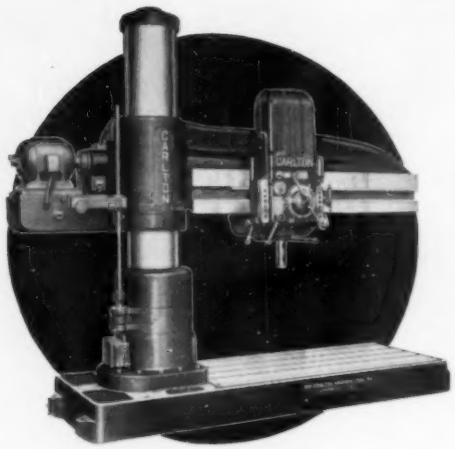
13"-15"-17" column 4'-5'-6'-7' arms

4A

19" column 6'-7'-8' arms

5A

22"-26" column 7' to 12' arms



Only one can be called the finest

Only Carlton offers you a choice of three speed-feed controls:

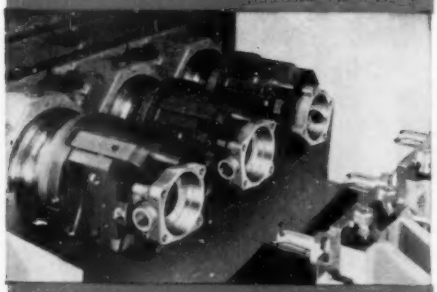
Programming for pre-selecting speeds and feeds for an entire drilling program including as many as 20 or 30 operations. *Pre-selector* for setting speed and feed for the next operation while machine is still under cut. *Manual* to take advantage of Carlton's centralized push button control. For further information, send today for free descriptive bulletin. The Carlton Machine Tool Co., Cincinnati 25, Ohio.

Carlton

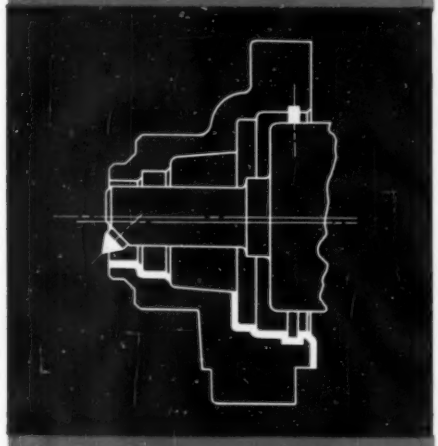
horizontal and radial drills

Intricate contouring is fast, accurate–

12 operations in one cycle!



Showing parts mounted in the chuck. Without chuck changes, any of three parts having different exterior forms but identical interior contours can be accommodated.



12 operations are performed in one machine cycle. Heavy lines denote surfaces machined.

Direct cam action—no levers—provides Ex-Cell-O Precision Boring Machines with accuracy, versatility and speed in difficult contouring operations.

In the application shown here—contouring an internal form in die-cast aluminum end covers—limits on diameters are held as close as plus or minus .0005 inch, and three work pieces are completed at a time. 12 separate operations are performed in one machine cycle, including precision boring, facing, chamfering and grooving.

Cams can be changed in minutes. Cam assembly swings out for quick, easy change. All motors are outside the base.

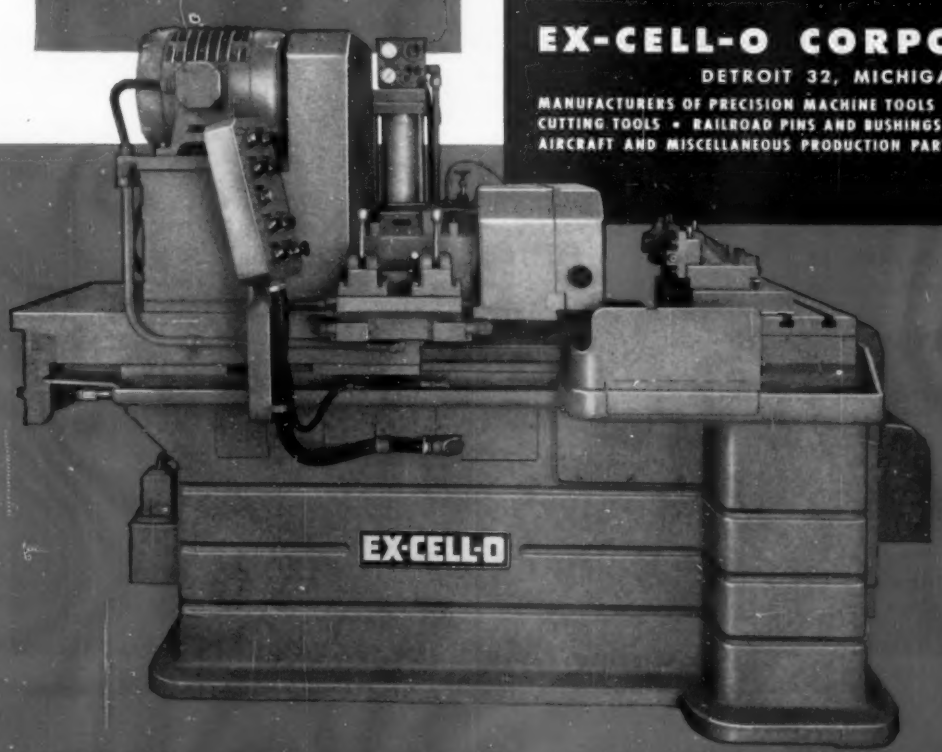
Another Ex-Cell-O feature is the large chip chute, cast as an integral part of the base. There are no openings where chips or coolant can enter the base. Contact your Ex-Cell-O representative or write direct for complete information.

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

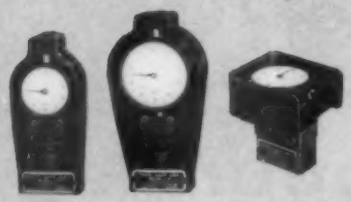
MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES
CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS
AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

56-

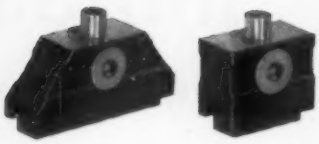


XLO
EX-CELL-O Air PRECISION

At left: The Ex-Cell-O Styled 312 Cam Operated Precision Boring Machine. A smaller model, the Ex-Cell-O Style 308, is also available because of the demand for this type of machine.



Gage unit components—for holding, adjusting and protecting dial indicators in special gage designs.



Gage blanks for large diameter countersink gages.

Internal groove gage components.

special gage designs simplified with . . . DAVIS GAGE COMPONENTS

Now available — a complete line of gage components for application in designing special gages. Wide selection of types and sizes available from stock.

Davis gage components eliminate designing, detailing and building many details of special gage designs. Both design time and special gage build costs are substantially reduced.

• • • •

New 136 page catalog #9 with tracing templates now available to gage process and design engineers. Send for your copy today.

Gage component application in special design demonstrated to process and design engineering personnel by special appointment. Write for particulars.

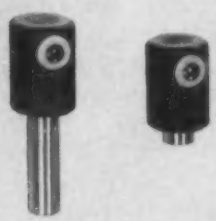
Davis mobile demonstrator.

A. G. DAVIS GAGE & ENG. CO.

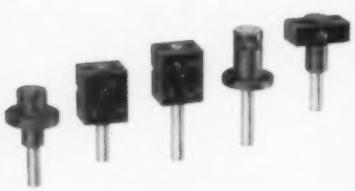
21435 DEQUINDRE RD. • HAZEL PARK, MICHIGAN

World's leading manufacturer of gage components for special flush pin and indicator type gages.

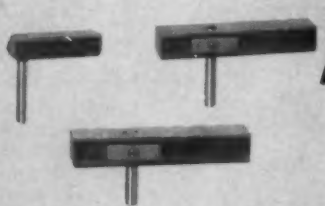
Depth gage bar and pin components. 1350 model sizes available from stock.



Barrel type flush pin gage blanks. 34 model sizes available from stock.

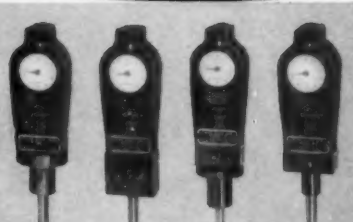


Gage body and pin components for built-up gages. A new concept in gage designing.



Bar type flush pin gage blanks. 46 model sizes available from stock.

Long series bar type flush pin gage blanks. 78 model sizes available from stock.



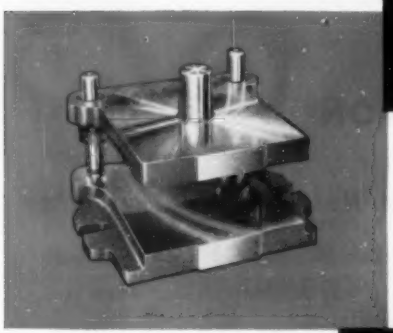
Gage component assemblies. Specified according to design needs.

NOW!

All Four Horizontal Surfaces Ground

ON NEW DANLY DIE SETS

To a large extent Danly leadership in die set design can be attributed to its constant search for better methods and means to improve die sets and their operation. Typical of this is the fact that Danly Die Set punch holders and die holders are ground on both sides. By grinding all four horizontal surfaces, Danly assures a true and level alignment when punch and holder are set in the press. Isn't this another important reason why you should specify die sets from Danly?



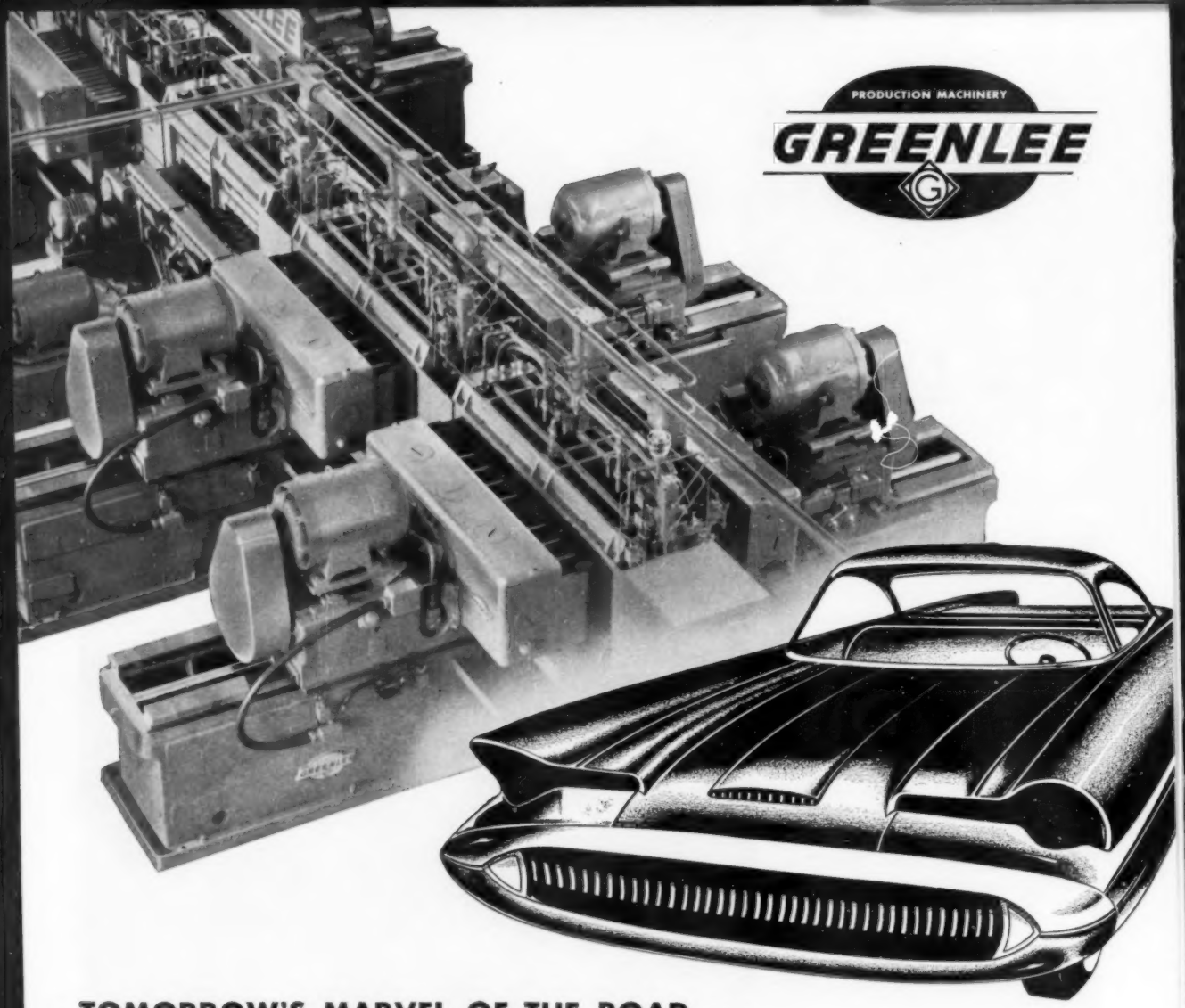
Complete new "leadership line" catalog

More than 200 pages provide you with complete design information, easier selection of die sets and supplies. Write for your copy today!

DANLY

DANLY MACHINE SPECIALTIES, INC.

2100 South Laramie Avenue
Chicago 50, Illinois



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TODAY A BIG, TOUGH JOB FOR PRODUCTION

Greenlee Ideas, Experience and Facilities Can Help You All The Way

Automobiles . . . airplanes . . . farm machinery . . . appliances. Whatever your product may be, the baffling problems of new model production have a way of disappearing when you invite Greenlee engineers to participate in your planning. These men have a knack (nurtured by long experience) for translating design into profitable, low-cost manufacturing. Their thinking is sound . . . creative . . . respected in many industries. Write or phone for a consultation today. It will pay you to investigate.

GREENLEE STANDARD AND SPECIAL MACHINE TOOLS

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Machines

PRODUCTION MACHINERY
GREENLEE

GREENLEE BROS. & CO.
1992 Mason Ave.
Rockford, Illinois

DIFFICULT JOBS ARE *routine on* DE VLIEG SPIRAMATIC JIGMILS®

PHOTO COURTESY OF DANROY BORING CO.

DeVlieg *SPIRAMATIC* JIGMILS® permit accurate machining of workpiece from 4 sides at 1 setting!

The above photograph, taken in a well known Detroit Tool Shop, illustrates a Special Hydraulic Fixture being machined on a DeVlieg Model 3B-48 *SPIRAMATIC* JIGMIL. This job was completely machined on four sides at one setting to precise limits of accuracy and operations included drilling, boring, milling and O.D. turning 22" diameter trunnion.

Come to Detroit...

See a practical demonstration of the JIGMIL Technique

DE VLIEG MACHINE COMPANY

450 Fair Avenue, Ferndale • Detroit 20, Michigan

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DOW

MAGNESIUM *machinability beats tight schedules*

Machinability and handling ease are two reasons Carr Lane moves jobs faster, at lower cost, with magnesium tooling plate

When a job has to be completed in a hurry, which is often the case at Carr Lane Manufacturing Company, St. Louis, there are big advantages in using magnesium tooling plate.

FASTER MACHINING. Production operations go faster because magnesium jigs and fixtures are easy to machine, easy to weld. Excellent dimensional stability and precision flatness help to hold the closest tolerances. These properties also help to save many hours in the process. On the fixture illustrated, it would take twice as long to do the job in aluminum—and ten times as long in steel.

FASTER HANDLING. The light weight of magnesium, two-thirds that of aluminum, permits pieces to be handled and moved from one operation to another with a minimum of time, effort and equipment. This is particularly important with large jigs and fixtures which couldn't be handled manually if they were made of steel.

FASTER AVAILABILITY. You can get magnesium tooling plate when you want it and how you want it. Whether production deadlines are tight or not, it's always readily obtainable in any standard size and gauge from stock. Contact your nearest supplier of Dow Magnesium or write to THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. MA 372L-1.

Available from stock at . . .

Copper and Brass Sales, Inc., Detroit, Mich. • Fullerton Steel and Wire Co., Chicago, Ill. • Hubbell Metals Inc., St. Louis, Mo. A. R. Purdy Co., Inc., Lyndhurst, N. J. • Reliance Magnesium Co., Los Angeles, Calif. • Vinson Steel and Aluminum Co., Dallas, Texas.

you can depend on DOW MAGNESIUM DOW

RED RING
HARD GEAR HONING
PRODUCES QUIET GEARS

Nicked Gear Tooth

Same Gear Tooth After Honing

Hard gear tooth honing is an entirely new approach to the vexing problem of intolerable gear noise arising from nicks, burrs, tooth roughness and minor heat-treat distortions.

Honing is not only far more effective than other processes used to combat gear noise but it is also much more economical. And it produces none of the undesirable after effects inherent in other processes such as heat checks, soft skin or residual stresses in the tooth metal.

Gear honing does four important things:

- Smooths off the swaged or raised metal surrounding tooth nicks.
- Eliminates burrs.
- Materially improves surface finish.
- Corrects minor heat-treat distortions in profile, index and lead.

When used as a final routine finishing operation following heat-treat, it eliminates the tedious and costly operation of searching for nicks and then correcting them. It improves the quality, uniformity and performance of all gears produced.

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING
AND ELLIPTOID TOOTH FORM

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

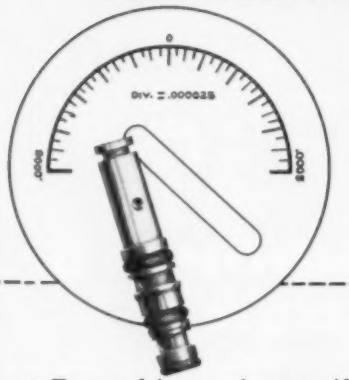
WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

Patents pending

7631

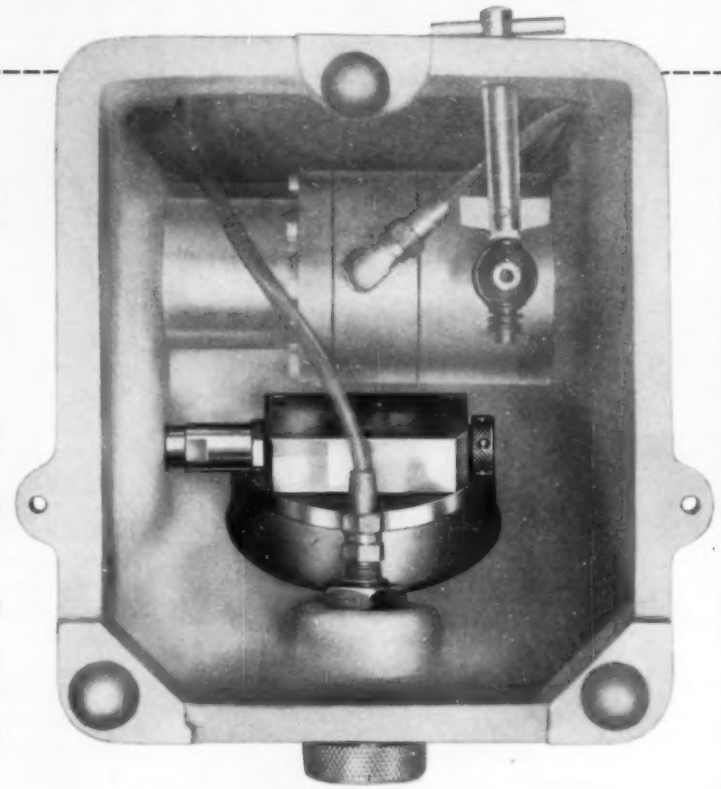
Get this Inside Story

for Lower-Cost Air Gaging



This simple venturi tube, and its corresponding dial, is the real key to more accurate, more trouble-free air gaging performance. The Taft-Peirce CompAIRator uses this tube in a unique *Venturi Circuit* which provides advantages not found in any other type of air gage. Check these exclusive extras . . .

- Easy and inexpensive magnification changes — switch this venturi and dial in just five minutes
- Only 10 pounds operating pressure, cuts air cost in half
- Fast reaction permits remoting base unit from fixture without using "booster" — no time lag or lowered sensitivity
- Velocity-type venturi circuit permits checking smallest diameters with standard gaging members — ID's down to .055″
- Wide tolerance range: can gage tolerances as narrow as .0001″, or can be designed to check as wide a range as .125″
- Full linearity through 180° of dial scale
- Built-in fast response, easily tied in with automatic machining and inspection operations
- Can be mounted at any angle without disturbing readings



Taft-Peirce Single Dial CompAIRator, complete with plug and masters. CompAIRators are also available in double or multi-dial units, can be used with standard air plugs, air rings, and air snap gages — directly attached to cabinet or to air hose. Special fixtures designed and built to order.

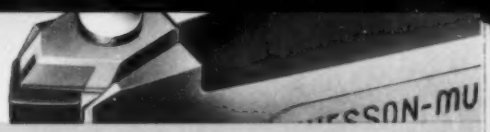
The simple Venturi circuit, extreme flexibility, and trouble-free operation make Taft-Peirce Air Gaging your lowest-cost quality control tool — whatever the production rate. It has been proved in hundreds of installations, performing all kinds of gaging operations.

Get ALL the facts . . . from your nearest Taft-Peirce representative, or write direct for Air Gage Catalog No. 613.

TAKE IT TO TAFT-PEIRCE

TAFT-PEIRCE MANUFACTURING CO.
WOONSOCKET, RHODE ISLAND

T-P Means TOP Precision



carbide NEWS

The Wesson Study Tells You:

1. To what extent your own industry is already using single point tools with throw-away tips.
2. What the future plans of your industry are with regard to use of throw-away tooling and why.
3. To what extent your industry is considering the use of throw-away blades for milling, boring, etc.
4. To what extent plants of your size can use throw-away tooling effectively.

WESSON can also help you select the right kind of throw-away holders and tips to give you maximum performance and economy, cut machine down time, reduce inventory and improve product quality.

Ask us to prove it.

WESSON makes national survey data available

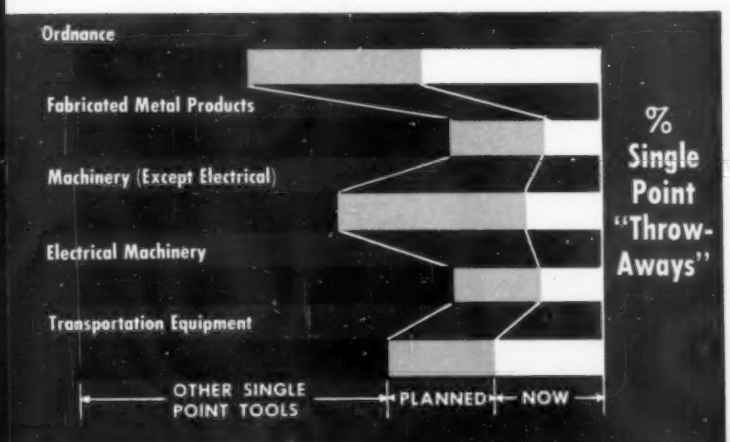
Industry Reports Big Jump in Use of Throw-Aways

HOTTEST NEWS in the carbide tool field right now is the astounding growth in popularity of "throw-away" tooling as revealed by the survey of metalworking industries by Wesson Company.

Conducted through an independent technical market research organization, the study shows:

1. Industry is seriously considering assigning a majority of all single point tool operations to "throw-aways". Some plants are thinking in terms of "as near 100% as possible".

(continued on next page)



THE BIG THREE IN THE THROW-AWAY FIELD ---

#1 INDUSTRY SAYS IT WANTS the features which WESSON has incorporated in all of its holders for single point tooling with indexable disposable tips, including STANDARD REPLACEABLE PARTS, ADJUSTABLE CLAMP WITH CARBIDE FACED CHIP BREAKER, ONE PIECE ANVIL LOCATOR, etc., etc. If you are not familiar with these holders, be sure to ask us for complete data covering holders for your types of operations. Our Bulletin 55-11-M will help you to do this quickly.

Industry Reports Big Jump in Use of Throw-Aways

(continued from page 1)

2. "Throw-aways" already represent over 15% of all single point tooling in metalworking plants. In those plants already using "throw-aways," the percentage is 25% of all single point operations.
3. Industry is receptive to the idea of using milling cutters that require no grinding on an even broader basis.
4. Industry is also seriously considering the use of no-grind (throw-away tipped) tooling for other multiple point tooling such as boring tools, etc. on a broad basis.
5. Primary reasons for industry's interest in tooling up with tips that are thrown away when dull are:
   a. Elimination of all tool grinding.
   b. Important reduction in machine down time for tool changes.

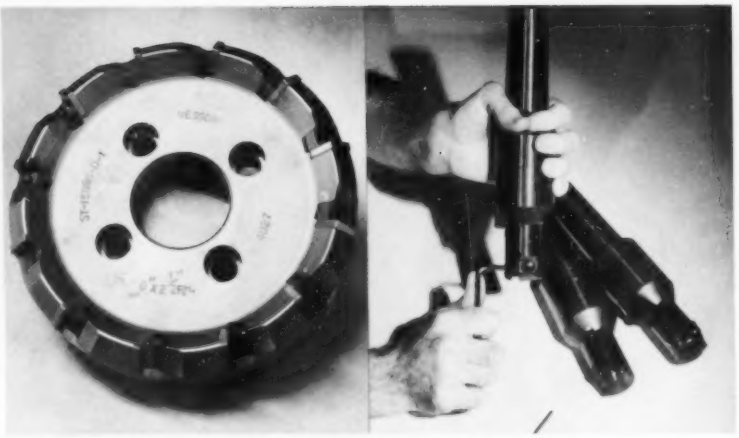
   Other factors include lower tool cost, reduced inventories, etc.

Included in the Wesson study are analyses of trends in the use of single and multiple point tools with throw-away tips by industry and by plant size (based on annual tool consumption). Results of the survey are available on request to all USERS of carbide tools.

tools Wesson carbide Wessonmetal

WESSON COMPANY DEPT. AD
1220 Woodward Heights Blvd., Detroit 20, Mich.

IN CANADA:
WESSON CUTTING TOOLS, LTD.
93 LEICESTER AVE., TORONTO 18, ONTARIO



THE BIG THREE IN THE THROW-AWAY FIELD - - -

#2 ***THE WESSON "NO-GRIND" Milling cutter, introduced at the Tool Show in Chicago promises to launch a new era in milling in the metal-working industries, according to reports by the industry itself. Using disposable carbide tips with eight cutting edges each, it eliminates all cutter grinding, reduces milling cutter inventory, cuts overall costs per piece.***

#3 ***THIS MICRO-ADJUSTABLE BORING TOOL with no-grind disposable inserts is one of a series developed by Wesson. It has all the features, apparently, that industry is looking for.***

"No-Grind" Chamfering Tools Added to Wesson Standards

Two new holder styles designed for 30-degree and 45-degree chamfering operations have been added to Wesson's line of standard Multicut holders for throw-away carbide inserts.

The holders offer wide versatility, being applicable also to straight turning, plunge feed turning and facing operations. The 30-degree lead angle style designated TDRC-TDLC is also suitable for 90-degree shoulder turning by angling the holder in the tool block. The 45-degree lead angle holder style is designated SERC-SELC.

Both holders incorporate low cost, standard replaceable parts including a one-piece insert seat and locator, adjustable carbide faced chip breaker-clamp, and locking screw. The TDRC-TDLC employs standard triangular "No-grind" inserts while the SERC-SELC are designed for use of standard square inserts which provide a total of eight cutting edges before discarding.

The large clearances provided in the design of these holders make them especially suited for "gang" setups. Sizes available are shown on Bulletins 896-1A (SERC-SELC) and 896-2A (TDRC-TDLC).

CUSHMAN chucks give Chuck-ability

CHUCK-ABILITY — The ability to SPEED your work . . . ELIMINATE fatigue . . . IMPROVE your products . . . and REDUCE your costs . . . through design and selection of the right work-holding devices.

the key to machining efficiency

One of the Cushman Jet Engine Chucks.

fficient machining of jet engine parts of large diameter and small cross-section to extremely close tolerances without strain or distortion was materially improved by the Cushman series of special chucks designed and built for this purpose. These chucks completely overcome the inherent difficulties of the operations and permit mass production of these vital component parts. The success of these new chucks is one more proof that Cushman gives **Chuck-ability** as an essential to efficient production.

Manufacturers throughout the country have long recognized and used the Cushman Engineering Department for solutions to chucking problems. We invite you to use this experienced service.

THE CUSHMAN CHUCK COMPANY
Hartford 2, Connecticut
a world standard for precision

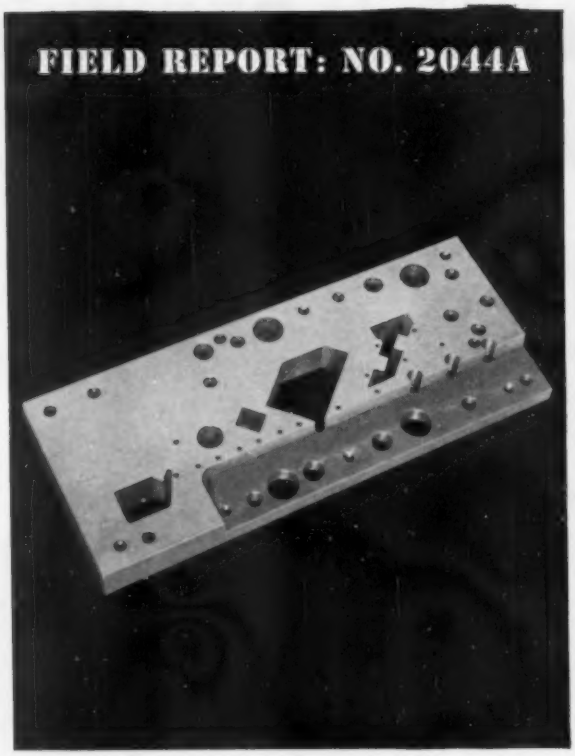
CUSHMAN the CHUCKMAN CHUCKS 1867

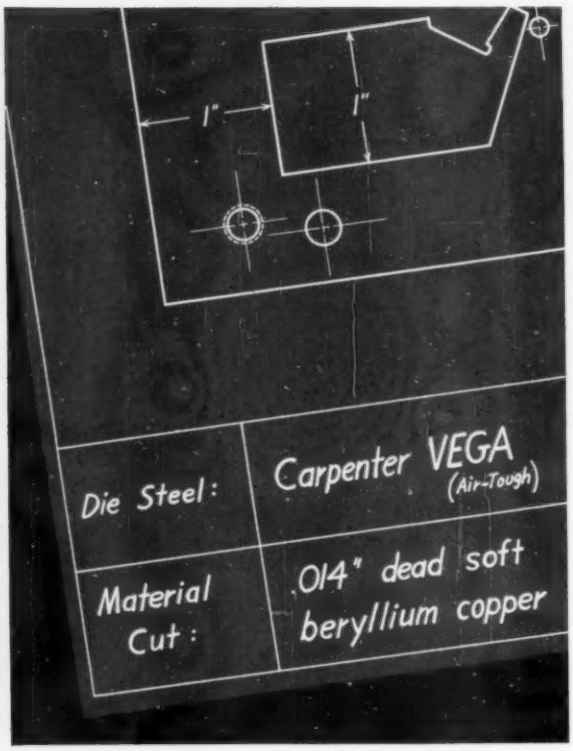
CUSHMAN CHUCKS . . . *A Product of American Quality, Labor and Materials.*

SEE YOUR INDUSTRIAL DISTRIBUTOR

manufacturers of:

Air Operated Chucks, Cylinders, and Accessory Equipment . . . The Cushman Power Wrench . . . Cushman Manually Operated Chucks and Face Plate Jaws.





WHICH DIE STEEL WOULD YOU USE

for hardening accuracy, safety in this critical die section?

Imagine the problems involved in making and heat treating this critical die section for cutting parts from .014" dead soft beryllium copper.

Numerous cut-outs, sharp corners and thinner sections milled almost through the length of the die present man-size problems in getting the section out of heat treatment safely and accurately.

Which die steel would you be willing to trust on this ticklish job?

Here are the results reported by the diemaker, who chose Carpenter VEGA (Air-Tough) Die Steel for the job: "The section is made from a piece of VEGA 1" x 5" x 12". To hold the stock in line, we had to jig bore and hold a line of ⅛" pilots almost through the entire die length. VEGA permitted us to do this and saved many hours of work over a die made from small sections. The first large perforating punch was also made from VEGA. After heat treatment, the punch entered the die perfectly. If there was any warpage at all in the punch, we couldn't find it."

This kind of performance is readily available to you by simply calling your nearest Carpenter Mill-Branch Warehouse, Office or Distributor. Large local stocks of Carpenter Matched Tool and Die Steels assure immediate delivery.

® U. S. Patent Office, The Carpenter Steel Co., Reading, Pa.

Carpenter STEEL

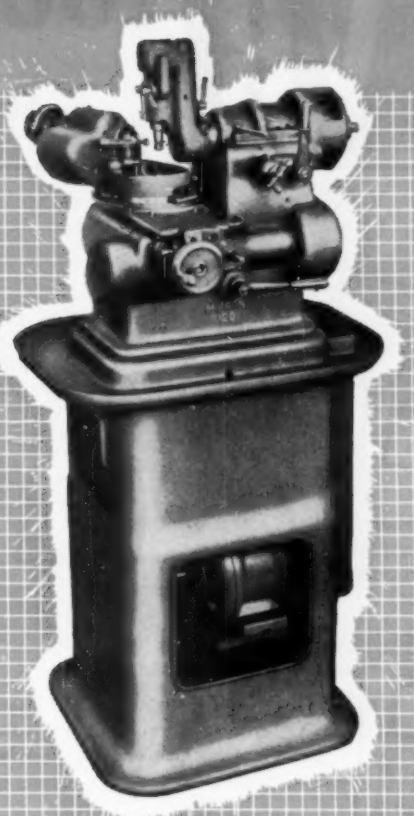
Matched Tool and Die Steels

The Carpenter Steel Company, 154 W. Bern St., Reading, Pa.

Export Dept.: The Carpenter Steel Co., Port Washington, N. Y.—"CARSTEELCO"

THE ULTIMATE IN

BEVEL GEAR ACCURACY



- low-cost tooling
- simplicity of set-up

NO. 120 MIKRON

fine pitch

BEVEL GEAR HOBBING MACHINE

RUSSELL, HOLBROOK & HENDERSON, INC.

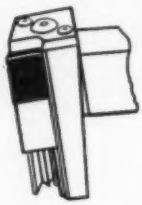
292 Madison Avenue, New York 17, N. Y.

V-R TOOLHOLDERS CUT

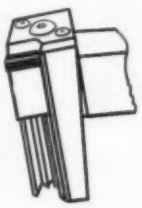
Savings Range from 10% to 200%!

V-R Longhead Toolholders Eliminate Carbide Waste

V-R longhead elevator type toolholders will handle any standard cemented carbide inserts up to 1½" in length.



This insert has been reground as many times as possible for use in ordinary toolholders.



In a V-R toolholder, the insert can be reground until it is no longer thick enough to take the cut required.

V-R toolholders cost less to use because of unique design features not found in any others:

Less Downtime because you do not have to reposition the toolholder when you replace or index inserts. Change of inserts is fast and easy — there are no loose pieces to fall out.

Lower Carbide Cost. You can consume up to 90% of a long insert, nearly twice as much as with other toolholders.

No Grinding when you use V-R toolholders and throw-away inserts.

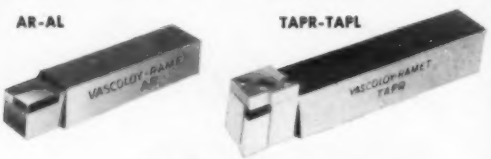
Long-Life Chipbreakers. V-R chipbreaker plates are made of a special cast alloy (not steel), chosen for its exceptional wear and shock resistance characteristics.

NEW CATALOG FREE ON REQUEST

. . . new Catalog No. VR-437 gives complete data on the design and construction of all V-R toolholders . . . contains dimensional drawings, parts lists and prices. Also describes V-R carbide inserts in grades to meet your needs. Get your copy now. Call your V-R Representative or Distributor, or write to Vascoloy-Ramet Corporation, Waukegan, Illinois.

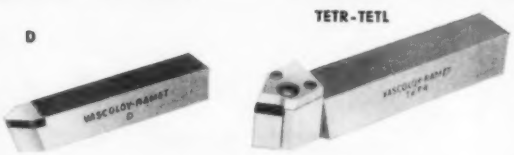
Styles to handle 90% of Your Machining Operations

Standard Brazed Tool — **Comparable Toolholder**

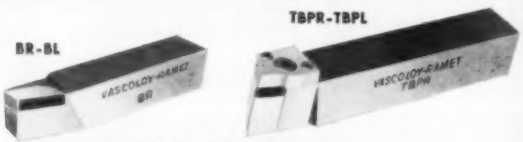


Straight Turning

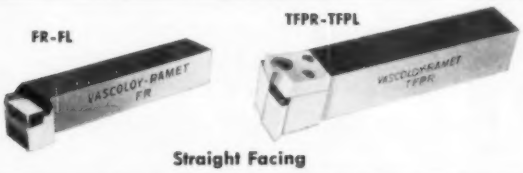
Standard Brazed Tool — **Comparable Toolholder**



45° Lead Angle Turning



15° Lead Angle Turning

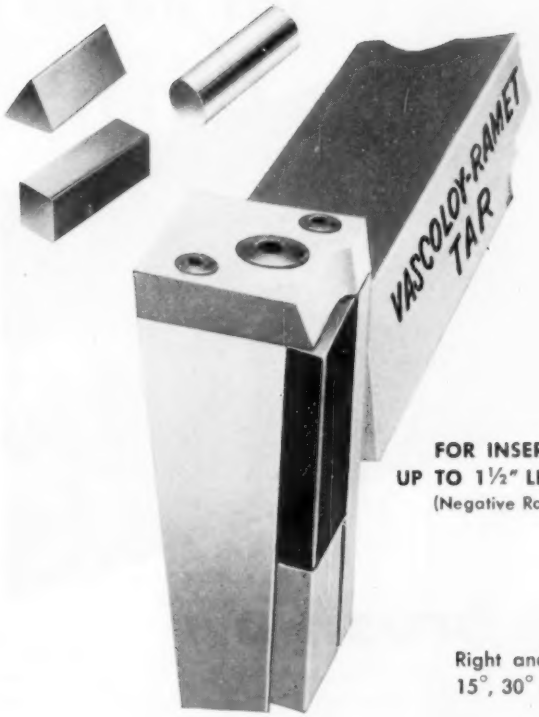


Straight Facing

30° Lead Angle Turning

15° Lead Angle Facing

CARBIDE TOOLING COSTS!

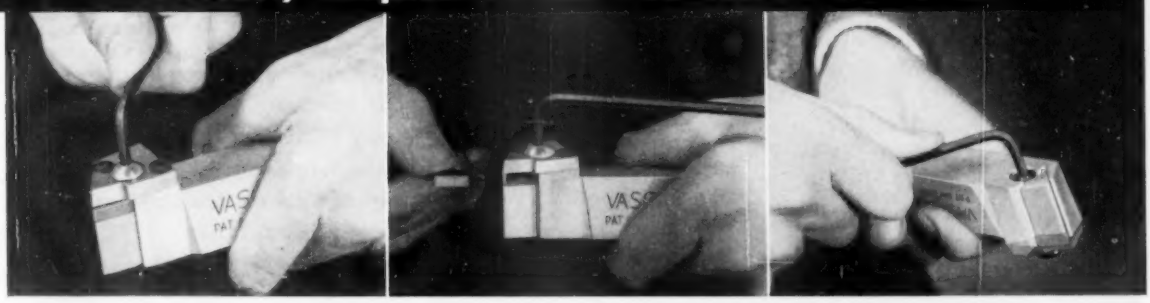


FOR INSERTS UP TO 1½" LENGTH
(Negative Rake)

FOR THROW-AWAY INSERTS
(Negative and 6° Positive Rake Styles)

Right and left hand styles for: straight turning; straight facing; 15°, 30° and 45° lead angle and plunge turning, and chamfering.

Fastest, Simplest-to-use Toolholder There Is!



Insert is clamped between adjustable elevator and fixed position chip-breaker plate. That's all there is to it!

Insert is removed and replaced in seconds. It is automatically indexed just by slipping it in place!

Works easily in any position, thanks to fixed position chipbreaker plate and socket in each end of main screw.

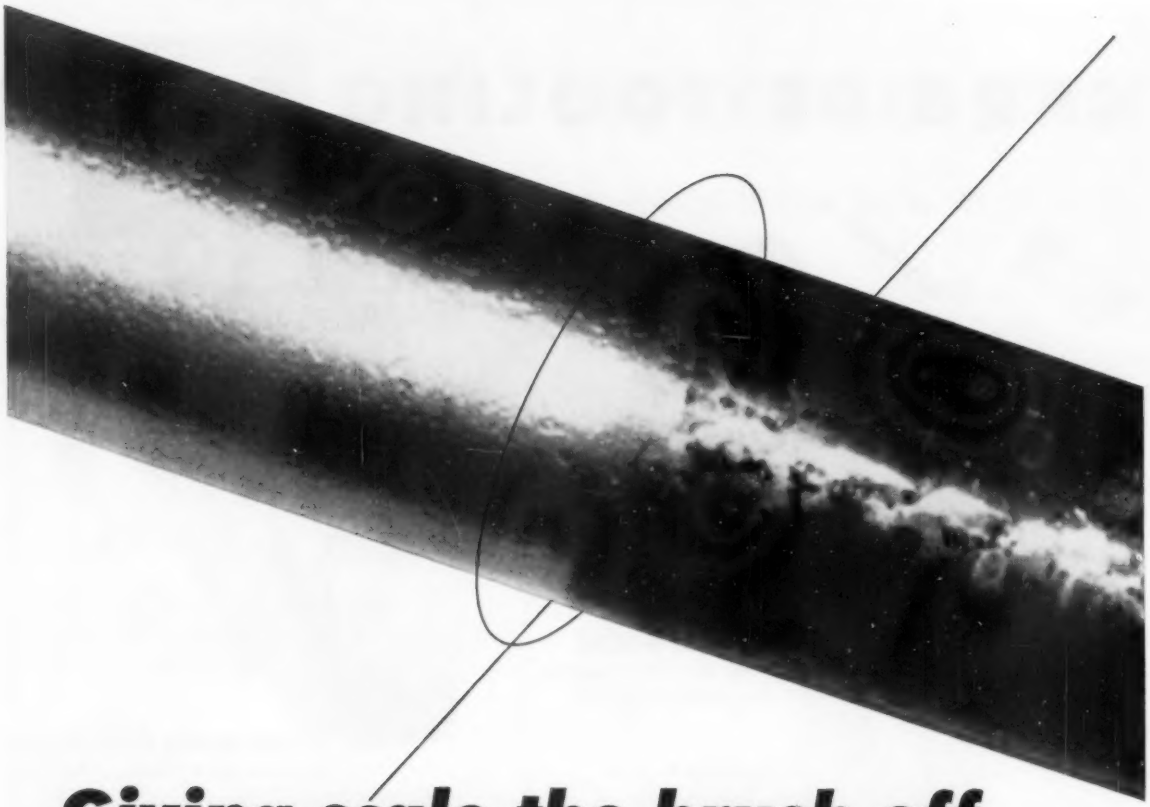
MANUFACTURERS OF:
CEMENTED CARBIDES, TOOLHOLDERS and TANTUNG® CAST ALLOY CUTTING TOOLS

Vascoloy-Ramet Corporation

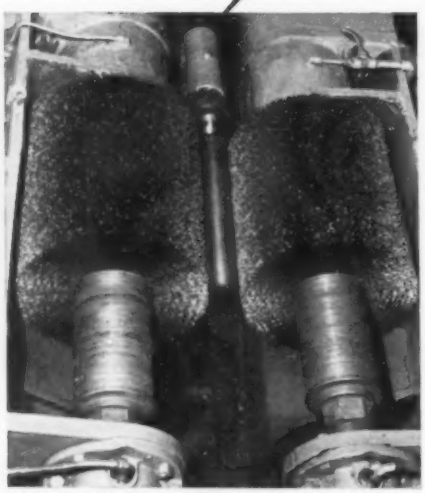
SUBSIDIARY OF FANSTEEL METALLURGICAL CORPORATION

880 Market Street • Waukegan, Illinois

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-61



Giving scale the brush off



Automatic Brushing Machine inserts end of tube between brush rolls . . . cleans rotating tube on predetermined cycle . . . stops and ejects tube.

SCALE and hardened preservative oil must be removed from the ends of boiler tubes prior to welding. Automatic Osborn power brushing proved the simplest and most economical cleaning method.

This is typical of the many new—and often unique—cleaning and finishing operations being performed in virtually every industry by Osborn Power Brushing Methods.

An **O**sborn **B**rushing **A**nalysis, made in your plant, will show how *you* can improve metal cleaning operations with power brushing. Write *The Osborn Manufacturing Company, Dept. K-29, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

COMPLETE DATA—For information on power brushes and brushing methods, write today for Osborn Catalog 300.

Osborn Brushes

OSBORN

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

Three for thrift!

Norton cut-off wheels... fast, safe and long lasting... bring you the profit-boosting "TOUCH of GOLD"

Norton has brought cut-off wheel development to the point where you can be sure of fast, clean cutting action, low rate of wear and a wide safety margin on every job.

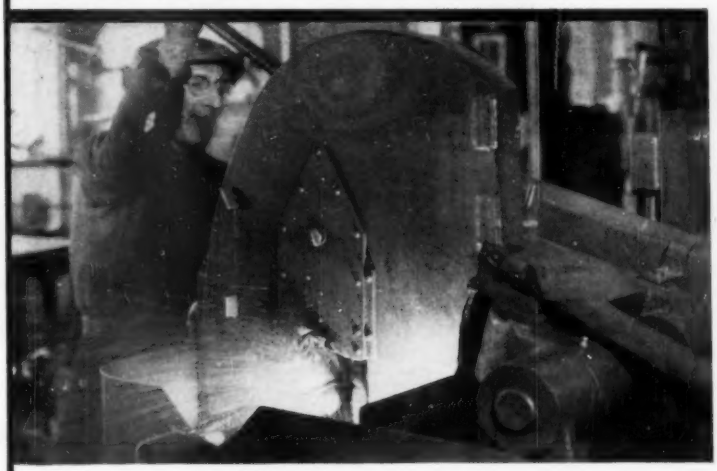
That goes for all metals, from softest to hardest — for non-metals ranging from rubber hose to marble — and for any type of machine, high speed or low speed, swing frame, chopper, traverse, floor stand or portable.

Three of the most popular Norton cut-off wheels are shown here. See your Norton Distributor for practical help in wheel selection and facts on dry vs. wet methods for your cutting-off operations. Or write to the nearest District Office of NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone book, yellow pages. Behr-Manning Company, Troy, N. Y., division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.

W-5704

B9 RESINOID CUT-OFF WHEEL

The B9 is an ideal high production wheel, adaptable to speeds up to 16,000 sfpm. Available with either smooth sides, or with the rougher "F" sides for greater chip clearance. An exceptional performer on both ferrous and non-ferrous metals. For dry cutting only.



R50 RUBBER CUT-OFF WHEEL

Designed primarily for wet-cutting metal bar stock, the Norton R50 rubber bonded wheel handles diameters up to 6". Built-in chip clearance — unusual in this type of wheel — is an advantage for freer, cooler cutting with minimum burr and without case hardening the work. Can also be used for dry cutting.

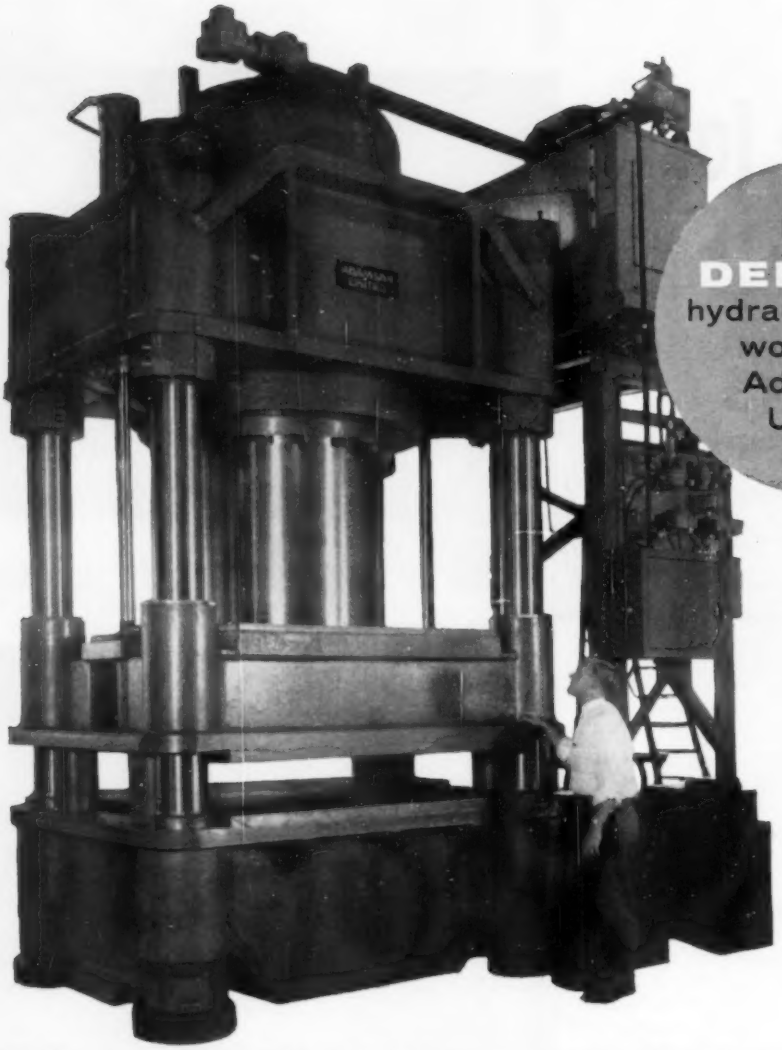
NORTON
ABRASIVES

Making better products... to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels
Grinding Machines • Refractories
BEHR-MANNING PRODUCTS: Coated Abrasives
Sharpening Stones • Behr-Cut Tapes

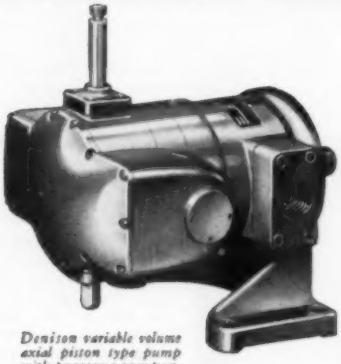
BN RESINOID CUT-OFF WHEEL

Extra strength and safety, plus knurled sides for more effective cutting action, make the reinforced, resinoid bonded BN wheel a great favorite for the widest range of jobs, especially non-ferrous operations. Other uses include: cutting wire rope; slotting railway track welds; tuck pointing; cutting fibre board, concrete, tile, plastics, and the like.



How **DENISON** hydraulic power works for Adamson United

Precision control for a metal monster



Denison variable volume axial piston type pump with pressure compensating control, key to this hydraulic system for Adamson United Press.

● To Denison Engineering went the task of designing accurate, foolproof control equipment for this huge compacting press built by Adamson United, Akron, Ohio. Covering more than 40 square feet of platen area, the press has a 40-inch ram designed to operate on a 2300 psi hydraulic system.

The control system developed by Denison employs a variable-volume axial-piston pump driven by a 15 h.p. motor. A manifold-type hydraulic panel completes the system.

Engineering consulting service like this is available to you at all times to save your design time and assure dependable, efficient performance of your hydraulic circuits. Write us. Denison Engineering Division, American Brake Shoe Co., 1182 Dublin Road, Columbus 16, Ohio.

DENISON HydrOILics

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

star performer

...and among high speed steels REX is the leader

Crucible REX® high speed steel has been the winner in shop tests for more than fifty years. *And now REX is even better than ever!* For Crucible research and experience has led to improved manufacturing techniques that mean higher quality – greater uniformity.

Prove the superiority of REX for yourself – on your next job. Check it for size, structure, response to heat treatment, all-around tool performance. Then you'll know why REX has always been the *standard by which other high speed steels are compared.*

REX is immediately available at all of Crucible's convenient warehouses – or through prompt mill delivery. For a list of available data on REX and other Crucible *special steels*, write for a free copy of the "Crucible Publication Catalog". *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Canadian Distributor — Railway & Power Engineering Corp., Ltd.

dixi 60

horizontal optical jig borer

with 5 optical microscopes

DESIGNED AND BUILT FOR:

VERSATILITY
Optical settings for operations in all planes and compound angles . . . Equally suitable for tooling, short-run or production work . . .

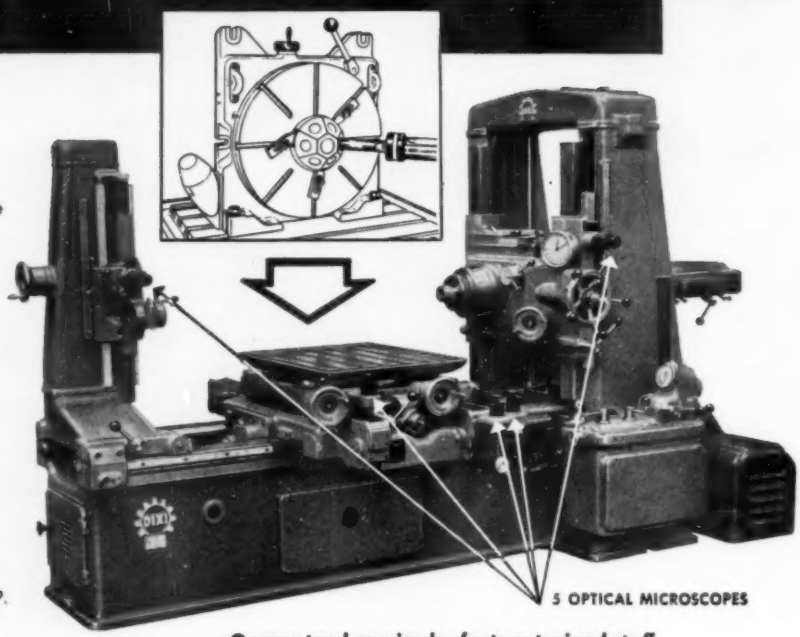
ACCURACY
Overall accuracy of .0002"

A precision machine for *JIGLESS* boring, facing, milling, and drilling work, in all planes. Built-in 360° optical rotary table, 28¾" x 32⅝". All spindle and table settings by optical microscopes. Infinitely variable hydraulic feeds. Mechanical spindle feeds with automatic depth stop. #40 taper spindle-speeds infinitely variable to 1400 R.P.M. Special features eliminate effect of spindle overhang on accuracy.

DIXI 450 PRECISION OPTICAL CIRCULAR DIVIDING TABLE

Direct readings of 1 sec.

(See insert picture above) rigidly mounted (not tilting) on built-in rotary table permits holding close tolerance relations between bores in all planes, including bores at compound angles. ALL IN ONE SET-UP. All sides of the work piece except the mounting face machined in one set-up.



5 OPTICAL MICROSCOPES

- ***Guaranteed service by factory trained staff***
- ***Engineering staff available for consultation***
- ***Spare Parts in New York stock***
- ***Your operators trained***

DIXI 60 now in wide use in leading Aircraft and Manufacturing Plants throughout the United States.

Names available upon request.

SEE THIS VERSATILE MACHINE IN OPERATION

at our New York or Cleveland Show Rooms. Write for Complete descriptive literature and prices to Department 21. Catalogues on additional production equipment also available on request.

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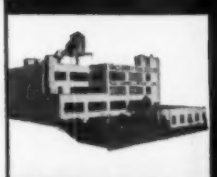

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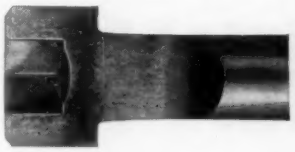

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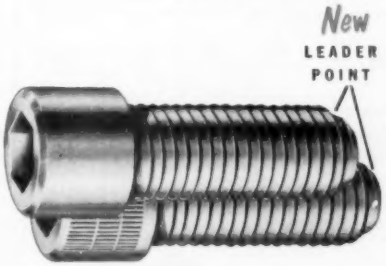

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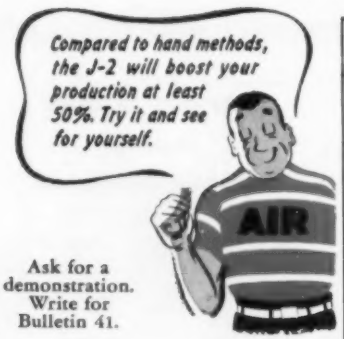

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SPECIFICATIONS

MODELS	Blows per Minute	Length	Weight	Square Drive*	Side to Center	Hose Connection	Rated Capacity, (Bolt Size)
J-2-S Side Handle	2100	6″	3#	½″	1⅛″	¼″	¼″
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HIGH CYCLE

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CLEVELAND, OHIO

UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS

How optical gaging helps get Giannini air-borne instrument production off the ground faster.

In the fight for flight that's higher, farther, faster—plane and missile makers want everything smaller, lighter, tighter. Tighter means tolerances today of 0.0002″ to 0.0003″ compared to 0.003″ to 0.004″ a few years ago. That's why more and more manufacturers like aircraft and missile instrument and control maker G. M. Giannini & Co., Inc., Pasadena, Calif., are using Kodak Contour Projectors.

A pulley in one Giannini instrument is less than pencil eraser size, has groove dimension tolerance falling between 0.010″ and 0.011″, four separate angles to check out within 0.30°, a shaft diameter of plus or minus 0.0001″ or 0.0002″. Perpendicularity must be within 0.0003″. Like many aircraft parts, it's made of aluminum alloy.

Before Giannini put a Kodak Contour Projector to work on receiving inspection, getting prototypes of instruments filled with parts like this—and even tighter—used to be a mammoth problem. An undetected off-tolerance part in the master could hold up production or even throw production models out of kilter.

At Giannini, inspectors check incoming parts quickly and accurately with optical gaging, make sure they're right for the prototype. They optically check angles, shoulders, radii, positions, and all critical surfaces on a single projector. Now there's less chance than ever that production parts will be off tolerance once the master has been approved.

If inspecting small parts to tiny tolerances is a large problem with you, you should investigate optical gaging with a Kodak Contour Projector. A Kodak Contour Projector can work production and quality control miracles where control of measurements makes a better product.

Write for your copy of "Projection Gaging with Kodak Contour Projectors." Even better, ask for the name of your nearest representative, so he can personally explain projection gaging's scope and capabilities.

Inspectors quickly learn optical gaging, because it's simply a matter of looking and comparing. Perhaps you can greatly improve Toolroom, Receiving, Production, and Final inspection with a single unit. There are six models to choose from.

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

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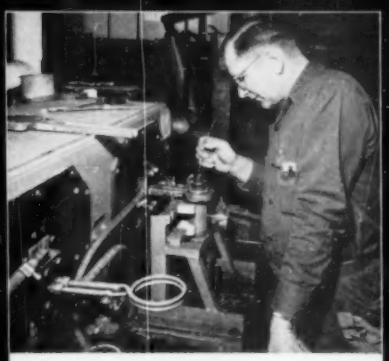

Jack & Heintz Inc. silver brazes over 25 different parts on this 15 KW, 10,000 cycle TOCCO machine.

with TOCCO* Induction Brazing

Brazing Costs Down

When Jack & Heintz engineers switched from torch brazing to automatic induction, brazing cost of these inverter brush mounts fell from $.05 to $.006 each —a reduction of 83% in direct labor costs alone! Additional savings result because less cleaning is required after TOCCO, and fuel costs are much lower, too.

Brazing Production Up

While costs dropped, production on the part zoomed —from 40 to 360 brazed assemblies per hour. Furthermore, rejects and scrap, formerly high, are now negligible.

Versatility

The part shown is just one of over 25 parts, large and small, which alert J & H engineers have converted from old-fashioned brazing methods to modern, automatic TOCCO. Overall brazing costs (TOCCO brazing versus former methods used) are down 75%—brazing speed, up 100%.

* * *

If the manufacture of *your* product involves brazing, heat-treating, forging or melting of ferrous or nonferrous metals, don't overlook TOCCO as a sound method of increasing production, improving product quality and slashing costs.

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The **Tool Engineer**

Spirit of Fellowship

The season is appropriate for discussing the subject of fellowship or brotherhood. We are caught up in the spirit of good-will and enjoy it to the utmost. Greetings are sent to old friends and new. A renewed appreciation of others creates a joyful feeling so we all join in the happy celebration.

We are reminded that ASTE has its spirit of fellowship too—especially at the chapter meetings. One of our better known ASTE'rs has said that one of the things he liked best about ASTE was that it retained the atmosphere of a fraternal organization as well as a technical society. The chapter meeting gives us a pleasant opportunity to visit with our fellow tool engineers and exchange experiences—personal as well as technical. The well-run chapter keeps the fraternal and the technical aspects of its meetings in proper balance so that its members enjoy not only professional advancement but comradeship as well.

We know that the spirit of fellowship thrives best in a moderately sized group. We know too that the percentage of members attending the chapter meetings is much higher in the so-called smaller chapters. Could this be the key to greater interest and attendance? Members of our outsized chapters should consider the possibility of chartering neighboring chapters which would multiply opportunities for leadership and comradeship.

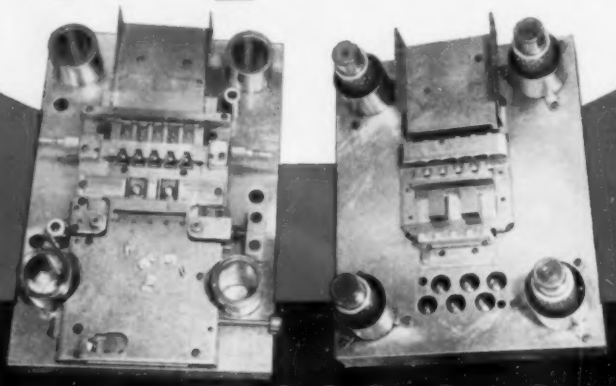
ASTE is growing rapidly. Let's remember that, as salt which has lost its savor is tasteless, so will ASTE become just another big organization if it does not retain its priceless ingredient.

A very Merry Christmas and a Happy New Year to each of you and yours!

H. C. McMillen

PRESIDENT

This Olympic FM DIE



produced 68,000,000 parts . . . and ready for more!

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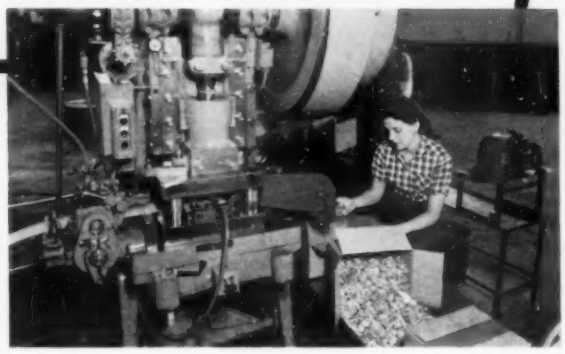

1 Excellent wear resistance of Olympic FM extended the normal life of the die.

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At Fisher Industries, Inc., Birmingham, Mich., the Olympic FM die (shown above) blanks and forms universal clips from .031"-.037" zinc plated #4 Temper 1010 cold rolled steel. When photographs were taken, a total of 68,000,000 pieces had been produced on a press operating at 330 strokes per minute fabricating 5 clips per stroke.

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For improved machinability and long production runs, order Olympic FM . . . Over 250 sizes are stocked in ten conveniently located warehouses.

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testing and training engineers for creative ability

By Robert W. Kubasta

Supervisor,
Engineering Training Dept.
Carrier Corp.
Syracuse, N. Y.

Fig. 1. Engineers in training class receive instruction in preparation for taking battery of tests for innate creative ability.

For engineering executives and administrators wishing to cultivate a greater creativity, here is as practical a blueprint as we have seen. This exclusive article resulted from a presentation before the Metals Div., Special Libraries Assn.

PRESENT SOCIETY and economy require a steady stream of new ideas and products. In fact, all successful businesses in this era of competition feed on new ideas. Career success is often dependent to a great extent on creativity or imagination. Few men are able to work up to the really high-priced jobs without contributing constructive ideas as well as having the drive and will to carry out those ideas.

Much of the attention given creative thinking is identified as "creative engineering." Perhaps that is because the development engineer represents a function whose name implies the responsibility for bringing forth new creations. New ideas must not be limited to product engineers. They must also come from the advertising and public relations departments, from sales and accounting departments, and manufacturing departments to provide means for increasing production at lower costs.

Like most personal abilities, creative thinking requires practice to develop skill. Everyone possesses creative talent to some degree, but what is it that makes some either have more or use more of such talent than others? It has been found that those who are productive in new ideas possess the following traits:

1. An active and inquisitive mind. This includes a ready observation of the things around them.

2. A broad knowledge—for without it, how could they recognize that tools and means were available for doing something in a new way.

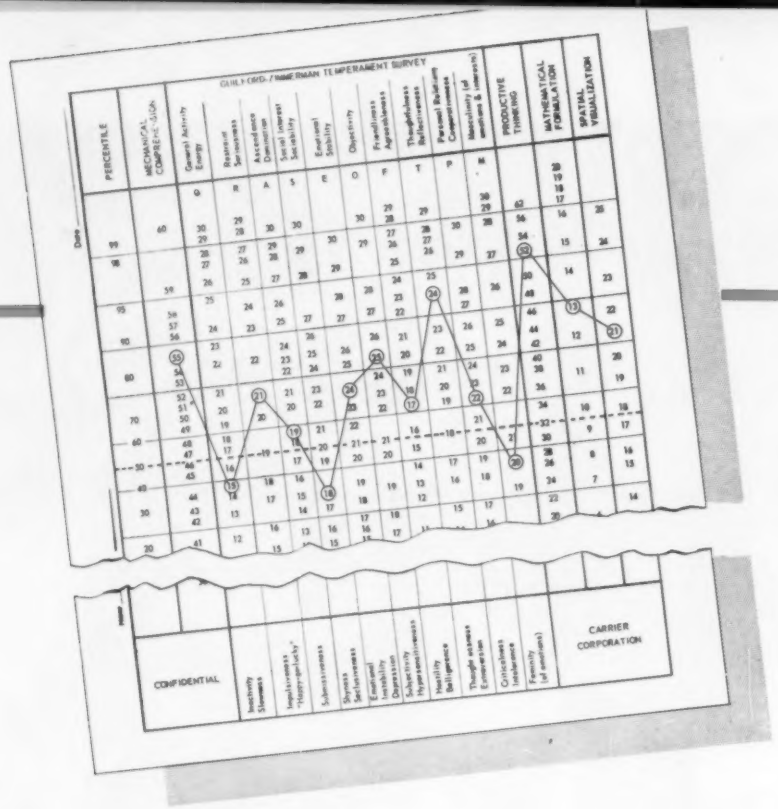


Fig. 2. Profile of an outstanding development engineer, showing a good pattern for creative work in the engineering field.

3. Constructive discontent, for if one is content with things as they are, one will never be stimulated to new ideas for improving them.
4. An inner drive, the motivation for which will vary from person to person, and from one situation to another.
5. An ability to approach a problem in a manner that will permit its solution.

While the latent creative ability of all individuals is capable of stimulation according to each person's basic creative capacity, there are those who possess these traits to a greater degree so that they are more creative than others.

The needs of industry today are such that firms must have a pool of creative talent from which creative thinking can be drawn as needed. Creative talents have to be identified as an ability and assigned as a responsibility. The problem of developing this pool of creative talent is twofold: first, that of identifying those with better than average creative ability; second, that of properly motivating those selected for that responsibility.

While there are many ways of solving this problem, the method that Carrier Corp. is using identifies those who appear to have above-average creative ability. At present, this is limited to the selection of engineers.

No means of taking direct measurements or readings to investigate thought processes are available. So, it must be done by comparisons or comparative tests, *Fig.* 1. Carrier has been able to arrange with the Psychological Services Department of Syracuse University for the development of such tests.

First, a series of tests was selected and given to a group of approximately 250 engineers already in the company. In fact, a man was required to have been with the company some minimum length of time to be eligible for the test battery, in order that he would have established some measure of his performance. At the same time, each man's performance in his job was evaluated. This was done through an analysis of job descriptions and requirements, a study of performance reviews, salary data and comparative ratings by supervisors and others familiar with his performance.

Next the project team made a study of test results and compared them with performance ratings, with the objective of picking out those tests which showed definite correlation with performance.

In some tests there was little or no correlation and those tests were discarded. Fortunately, there were several tests which showed definite correlations. These are the ones now being used for selection of engineering personnel and in placement of engineering talent.

A profile sheet, *Fig.* 2, is used for plotting all test scores in percentiles. The percentiles used on this sheet are the test results of the group of 250 engineers. In other words, the norms against which an individual's score is compared are those of company engineers. The scales have been adjusted so that the 50th percentiles are all at the heavy line

across the center of the page.

The first test of mechanical comprehension indicates a man's general mechanical aptitude. The next ten columns are devoted to a temperament survey, indicating a man's personality and disposition as they apply to his relations with other people. These cover such traits as general activity or energy, restraint, domination, sociability, emotional stability, objectivity, friendliness, thoughtfulness, cooperativeness and masculinity of emotions.

The columns on the right cover three tests of a somewhat higher level: productive thinking, mathematical formulation and spatial visualization. It may be interesting to take a closer look at these tests and see how they tie into the identification of talent for creative engineering.

The test of mechanical comprehension is a multiple choice test, involving some sixty problems dealing with such things as levers, gears, pulleys and mechanical forces. A sample problem from this test is shown in *Fig.* 3. One would expect an engineer with above-average creative ability along mechanical lines to score above average in such a test, since his ideas must eventually be put into an operating unit to be of practical value.

The temperament survey is also a multiple choice test comprised of some 300 questions. A typical question is: "Do you find yourself hurrying to get places even when there is plenty of time?" The choices are "yes," "no" and a third that indicates no answer can be given by the person.

In examining the profile sheet, *Fig.* 2, the first temperament trait scored is that of "general activity or energy." A high score indicates a person with strong drive; if coupled with the right other qualities, this is good. Too high a "G" score alone could indicate random behavior and wasted effort—certainly not a desirable quality in a research or development engineer.

The next trait is that of "restraint or seriousness," as contrasted with the impulsive, happy-go-lucky individual. The research or development engineer would be expected to be more restrained and serious.

"Ascendance or domination" is more relative and the need for it varies according to the extent of face-to-face contacts and the extent to which the supervision of others is involved. The creative engineer might or might not be in a supervisory position.

The "social interest" as contrasted with "shyness or seclusiveness" is self-explanatory. From the stories or biographies of the more famous inventors, "creative genius" might be expected to score on the low side of this scale.

The next trait is that of "emotional stability." A high score indicates optimism and cheerfulness as well as emotional stability. This trait may not be too indicative of the creative engineer, except that one of the reactions that motivate a creative man to new ideas is his dissatisfaction with things as they are. Whether that would carry to "depression" is a point for the psychologists. The next column on "objectivity" does not enter too strongly into the selection or identification of the more creative persons.

The seventh column measures "friendliness." Since the creative talent sought is that for a pool of talent instead of the flash of genius of the individual, a man who can work well with others is desired. He must be able to accept the suggestions of others; to pass along his ideas which might appear quite radical to others working on similar assignments; he must see his ideas scrutinized in the details of the drafting layout; and he must assist in carrying them through to production. So, the creative engineer must be friendly, at least to the extent that he is not down at the "hostile" end of this scale.

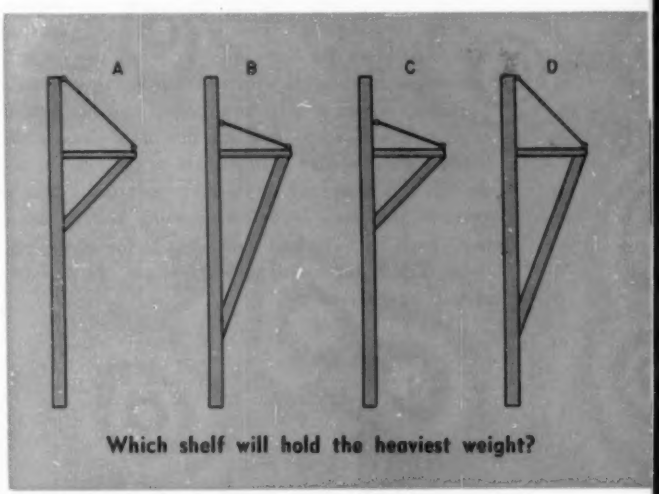


Fig. 3. Typical example of type of problems used in mechanical comprehension test.

Since creative thinking is being looked for, "thoughtfulness" might be expected to be the most important item in this test profile, except that this test does not apply to that type of thinking. This survey is aimed at personal relations with others and thoughtfulness as used here would be more important for the selection of supervisors than to the selection of creative talent.

The "P" score is a good criterion of human relations. In a discussion of the friendliness score, it was indicated that good cooperation is necessary, so it is to be expected that this score on "personal relations and cooperativeness" should also be above average for the development engineer. The last score is difficult to describe without a lengthy discussion, and does not bear too heavily on the

identification of the creative engineer.

The two tests described thus far are given to all engineering candidates. If a candidate qualifies under these for an assignment in research and development work and he has expressed an interest in that type of work, then he would be given three other tests at the time he is making a personal visit to the plant or even after employment. Whereas the tests just described show whether a man has creative ability, this series tries to show how much.

The first of these is a test of "productive thinking." In this test certain hypotheses are set up, and the individual is asked to report as many possible effects or results as he can. A sample question is: "Chemical research has produced a new gas called 'Invane.' It has remarkable properties. It contracts when heated and condenses to a liquid at 90 C. Condensation results in the absorption of 300 calories per gram of Invane. It is nonflammable and costs less than acetylene. What are the consequences of this discovery? What ideas occur to you?"

The next column reports on a test of "mathematical formulation." This is a multiple choice test which requires the individual to select the correct mathematical formula with which to solve a certain problem. Again it is to be expected that the better engineers will score well on this test, since such mathematical ability is important to their work, although this does not necessarily indicate a man's creative abilities. A typical question is: "A man saves each year one half more than in the preceding year. The first year he saves *a* dollars. In *b* years he will have saved":

$$\text{(A)}\ \frac{a^2 + b^2}{3/2};\quad \text{(B)}\ \frac{2b\,(a^{3/2} - 1)}{a + 1};$$

$$\text{(C)}\ 2a\left[(3/2)^b - 1\right];\quad \text{(D)}\ \frac{ab^{3/2} - a}{(3/2)^b - 1};$$

$$\text{(E)}\ \frac{a\,(3/2 - 1)}{b + 1}.$$

The last test is that of spatial visualization. In this test, as shown in *Fig.* 4, a man must select the figure or object which can be made from a given flat pattern. The development engineer must be able to visualize his new designs, and so he would be expected to be above average in this test of ability to visualize the construction of three-dimensional objects.

It should be pointed out that these last three tests all have specific time limits. In that way they measure not only the man's ability but also his speed in these respective talents.

It should be interesting to look at a typical test result plotted on the profile chart, *Fig.* 2. This is an actual test score of an engineer in the company, whose assignment includes the responsibility for creative thinking. He is now in a senior position and highly successful at development work.

The development engineer is well up on mechanical comprehension score, as is to be expected. His general energy or activity score is low compared to that of sales personnel tested. He is more restrained and has less social interest. His friendliness score is not high, but it is well above average, in contrast to that of the typical salesman who scored down at the 40th percentile on this trait.

His productive thinking score is high and this is accompanied by good scores on mathematical formulation and spatial visualization. This man's profile pictures the characteristics of a successful development engineer.

It must be remembered that no two profiles are going to be alike, particularly as to the temperament survey. Of course, there is no such thing as the average man. The normal profile will have a series of peaks and valleys and it is the interrelationship of these that is more important than any one trait. Furthermore, these tests are not the only criterion in the selection or placement of personnel; they are a means of helping do the job.

Having examined the problem of identifying those with better than average creative ability, let us look at the second problem—that of properly motivating those selected for that responsibility.

The first and most common suggestion for such motivation would be money, i.e., high salaries. Certainly that is a necessary consideration but the problem is not that simple. Any corporation has an obligation to its stockholders to make a reasonable profit, so the profit-and-loss statement places limits on what can be paid for certain services. If the money were available, how does one establish its equitable distribution? One man may produce twice as many ideas as the next but perhaps the second man's problem was twice as hard. No, it takes more than monetary returns.

Working conditions are important, and these can be divided into two areas. The physical and mental cover such items as an adequate office space, good laboratory facilities, sufficient test instruments, and funds with which to build samples and models.

Even more important are the mental working conditions, and this is a responsibility of supervision. Department heads and management must be receptive to new ideas. Nothing shuts off the flow of ideas faster than the response that "it won't work," or "we have tried that before." Maybe it has been tried before but maybe this idea is just enough different so that it overcomes the reason for failure of the earlier attempt.

Now assuming that the man is satisfied with his salary, enjoys his working conditions and has a supervisor receptive to new ideas and suggestions, can creative talent be stimulated so as to make it

available when needed? Yes, much of the literature on creative thinking is devoted to techniques for doing just that. It may be identified as "problem solving" but the need for a new idea presents one of the most challenging problems.

The problem solving technique which is described repeatedly in the most literature on this subject of creative thinking, is that of "brainstorming" sessions. Many companies are using it in varying degrees. The technique is generally credited to Alex Osborn who has used it for many years in his work at the advertising agency of which he is a partner.

What is a "brainstorming" session? It is an informal meeting of a small group of people called together for the purpose of obtaining as many ideas as possible on the solution of a specific problem. The group should number about ten. It is well not to mix supervisors with their own assistants because either one may hold back ideas for fear of what impression it would make on the other. Informality is a "must," if for no other reason than to make the atmosphere receptive to all ideas, whether good or bad. Quantity of ideas is the objective, with the thought that the more ideas there are from which to choose, the better is the chance of getting a good one.

To introduce the technique to company engineers, the subject was first presented at a meeting of the research and development forum with all development engineers in attendance. The response was enthusiastic. This was followed with a series of creative engineering workshops which had a dual purpose.

First, and most important, was to demonstrate this technique for obtaining ideas on the solution of a problem. Second, by using real problems of current importance to Carrier, the potential of obtaining a solution from one of these sessions was there. This gave the meetings a practical aspect.

Groups of ten were picked at random from the roster of engineers. There were both senior and junior engineers in all groups, but never both from the same department in any one group. Since the primary purpose was to demonstrate the technique, men from the department involved with that particular problem were not included.

Each problem was reduced to a concise statement and distributed to the group two days in advance of the session. A chairman was chosen for each session, along with an expert from the department originating the problem. This expert was present to answer questions as a part of the problem description, but he was not allowed to offer any judicial comment.

In sessions lasting from one and one-half to two hours, anywhere from 22 to 56 ideas were accumulated on a particular problem. Most of them were of no value; some were ridiculous, but perhaps it was those which prompted the several ideas which have since been put into patent applications.

The ideas were recorded on the blackboard as fast as they were presented. They were copied by a secretary as the session progressed so they could be transcribed into a permanent record. As soon as a copy of the ideas was available, a committee of "experts" met to evaluate the ideas. That was really the hardest job, to decide whether the idea had merit without investing time and money in its investigation. Then the original group met again within two days of the first session to add any more ideas and review the evaluations.

To further stimulate the use of this technique within departments, a workshop session is planned, made up only of department heads, with the thought that its success will encourage their using the technique to a greater extent on problems within their department.

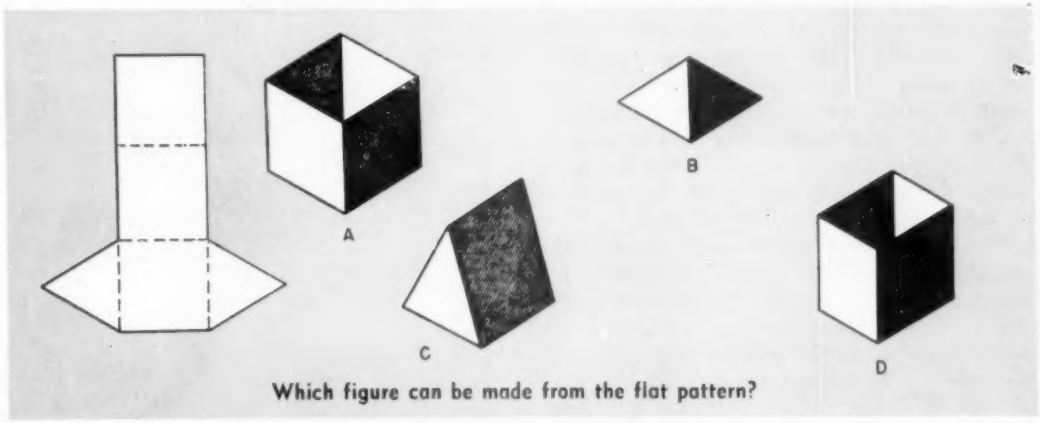


Fig. 4. Typical example taken from the spatial visualization test.

Gadgets

Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work

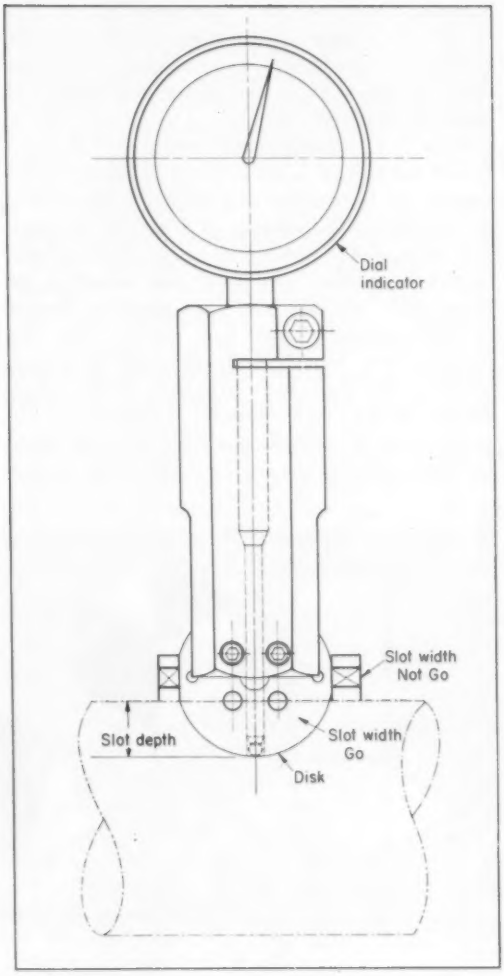
LAST CHANCE!
Gadgets contest closes December 31. See list of cash prizes and other details elsewhere in this issue.

Woodruff Keyway Gage

Depth and width of Woodruff keyways can be quickly determined with the gage illustrated. The gage consists of a circular disk attached to an indicator through a handle. Width of the disk corresponds to the "Go" dimension of the keyway. Two small projecting members attached to the disk serve as "Not Go" portions of the gage and act as stops for depth-measuring operations. The disk can be rotated 180 degrees when one half becomes worn or damaged, thereby doubling disk life.

The indicator dial is set to zero by pressing the bottom of the handle against a surface plate. This brings the bottom of the disk flush with the handle. When the disk is inserted in the slot, slot depth can be read directly on the indicator dial. The gage has proved to be fast and easy to use.

William E. Sjostedt
Sodertalje, Sweden



Machining an Ellipse

Elliptical punches and dies can be machined to correct goemetrical shape with standard machines and tools, using the methods illustrated. The ellipse is produced by feeding a workpiece at an angle with respect to the circular motion of a cutting tool.

To make an elliptical punch, a circular blank is roughed out, leaving the diameter slightly larger than the major diameter of the finished ellipse. The lathe compound is set at an angle to obtain the required angular feed. Size of the angle can be determined from the formula:

$$\cos a = \frac{\text{Minor axis}}{\text{Major axis}}$$

Shims are used to bring the center line of the blank in line with the center of rotation of the lathe. A boring head or turret lathe knee tool is mounted on the face plate. Balancing weights, not shown, should

be attached to the side of the face plate opposite the cutting tool. The cutter and cross feed are adjusted so that the cutter comes into light contact with the workpiece. As the cutter rotates the workpiece is fed through the circle described by the cutting edge of the tool. After each pass the spindle is stopped and the tool is fed in. This is continued until the punch is brought to size.

Because the workpiece is set at an angle, the elliptical section will be longer on one side than on the opposite side. The punch can be made longer to compensate for this, or the section can be blended in by filing if the cross section is not critical at that point.

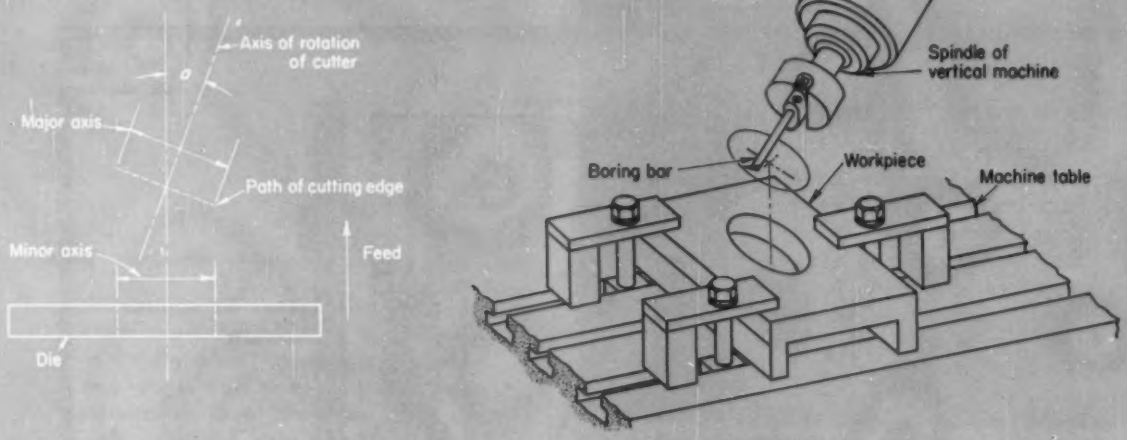
An alternate method for making elliptical punches is to mount the blank vertically in a milling machine vise. The spindle is inclined at the correct angle and the work is fed vertically by raising the table. A boring tool is used to cut the desired ellipse.

A similar method is used to cut an elliptical hole in a die. The hole is sawed to approximate size prior to machining, and the workpiece is set up in a vertical miller as illustrated. After inclining the spindle to the correct angle, the workpiece is centered under the cutter head and the table is locked in position horizontally. Feeding is accomplished by raising the table. The cutter is fed out after each cut until the opening reaches the correct size.

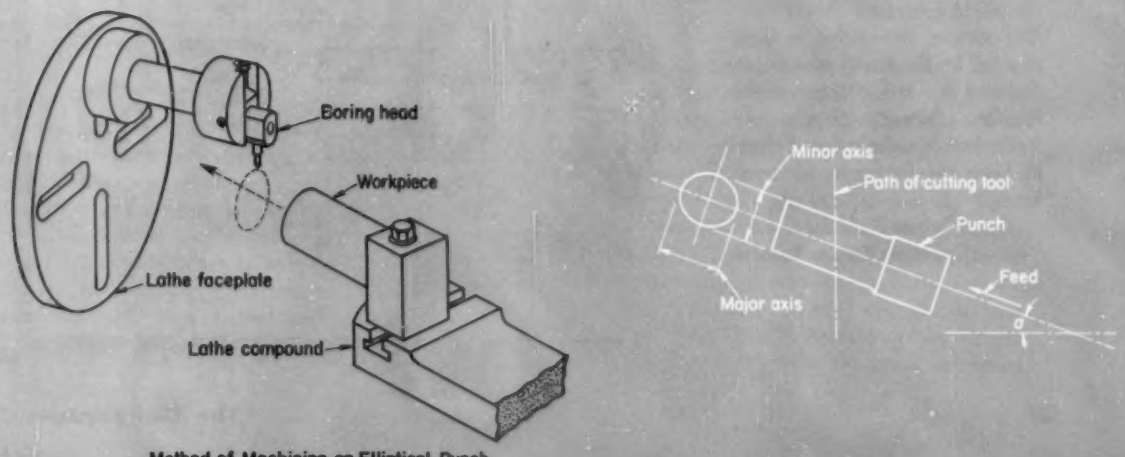
A boring bar with a large offset should be used so the shank of the bar is approximately in line with the center of the spindle. This provides sufficient clearance to prevent the shank from striking the edge of the opening as the cutter approaches the bottom of the hole.

The methods described will produce accurate mating elliptical punches and dies. It is unnecessary to shave a die with a mating punch and file and check the clearance with shims as is usual with elliptical punches and dies produced by other methods.

Clint McLaughlin
New York City, N. Y.



Method of Machining an Elliptical Die

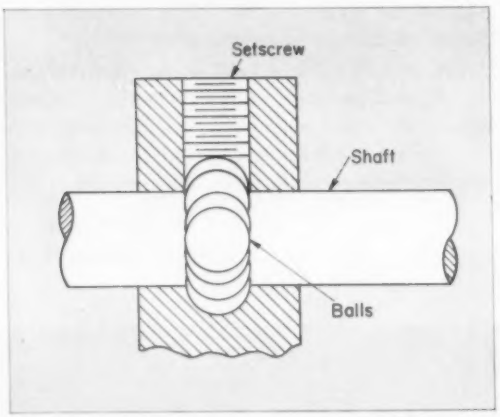


Method of Machining an Elliptical Punch

Gadgets

Shaft Retainer

Shafts on some items of shop equipment, such as precision grinding vises are sometimes retained by a piece of wire inserted between semicircular grooves cut in the shaft and the component into which the shaft fits. When it is necessary to dismantle the vise for reconditioning, it is impossible to remove the wire without destroying either the shaft or the stationary component.



A better means of retaining the shaft is to enlarge the grooves to accommodate a number of small steel balls. A radial hole in the housing provides a means of loading the balls into the groove. The hole can be closed with a flat-end setscrew locked in place with a second setscrew. An alternative method is to use a cap screw of the right length with the head locked against the top surface of the hole.

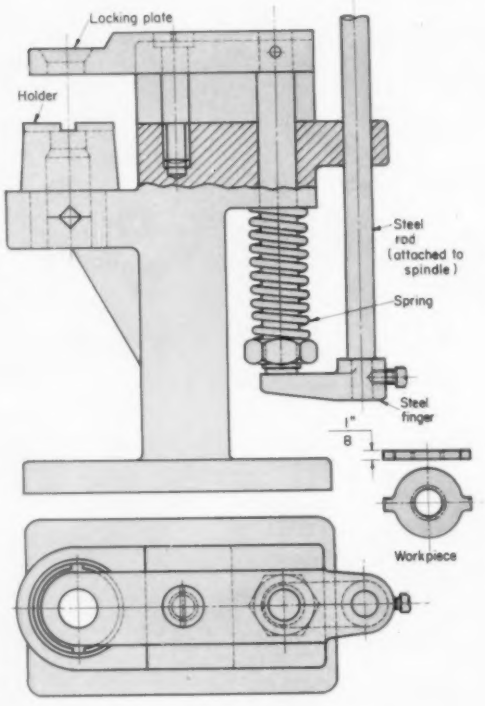
This arrangement for retaining a shaft has also been used to provide a light duty thrust bearing for an instrument assembly. It saves the space which would otherwise be required for two collars, functions well, and the finished unit is clean cut in appearance.

Ernest Jones
Bronx, N. Y.

Threading Fixture

Accurate threading of pierced holes in small stamped parts has been facilitated by the use of a fixture equipped with an automatic locking device to hold the stampings in position for the threading operation. The workpiece is positioned in the holder illustrated. As the spindle of the drill press is fed downwards, the locking plate is actuated by a compression spring, holding the workpiece down during the threading operation. As the spindle retracts, the spring is compressed by the action of a finger fastened to a rod attached to the spindle. Simultaneously the workpiece is unlocked and ejected from the fixture by air pressure.

Hjalmar Dahl
Upplands Vasby, Sweden



spray lubrication

—improves productivity

—cuts costs

By Erie H. Cocks*
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Eclipse Air Brush Co.
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Advantages of spray lubrication include exact control over the amount of fluid applied, speed of application and adaptability to automation. These advantages are discussed by the author, along with details of interesting production applications.

Fig. 1. Spray application of parting compound to tire molds results in even coating and is faster than brush or swab application.

UNTIL RECENTLY, the application of heavy lubricants, parting compounds and drawing fluids was accomplished with swabs and brushes. As production processes became more automatic it became apparent that this method of lubricant application was a definite hindrance to over-all production efficiency. In stamping operations, for instance, the installation of "iron hands" and similar loading and unloading equipment made it difficult to brush drawing compound on all parts of the die. Application of the proper amount of lubricant was left to the whim of an operator, who, too often, would make a fast swab with a brush, trusting to luck that all parts were being correctly lubricated. Since modern lubricants work best when applied properly, such haphazard lubrication methods often affected die life and product quality adversely. An added disadvange of applying drawing compounds with a brush is the possibility of the compounds, usually kept in open containers near the press, becoming

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contaminated with gritty particles and other foreign materials which eventually would be deposited on the surface of the die.

Hand-Spray Methods: The objections to brush or swab application of lubricants to dies also extend to similar methods of lubricating machinery and equipment. A typical example is the application of light grease to open gears in a steel mill. When swabs were used in lubricating these gears, it was difficult to control the amount of grease applied and, because it was often undesirable to stop the gears during lubrication, the operation was somewhat hazardous.

In many cases today, manual swabbing operations have been replaced by spray lubrication, *Fig.* 1. The operator carries a standard hand spray gun fitted with a two-foot extension nozzle. Lubricant is contained in a small pressure can. An even coating, reaching all required surfaces, can be applied without the nozzle ever making physical contact with the moving parts. The nozzle can be selected to spray the exact width required, and various types and weights of lubricants can be used. It is easy to spray lubricate surfaces which would be inaccessible with a brush or swab.

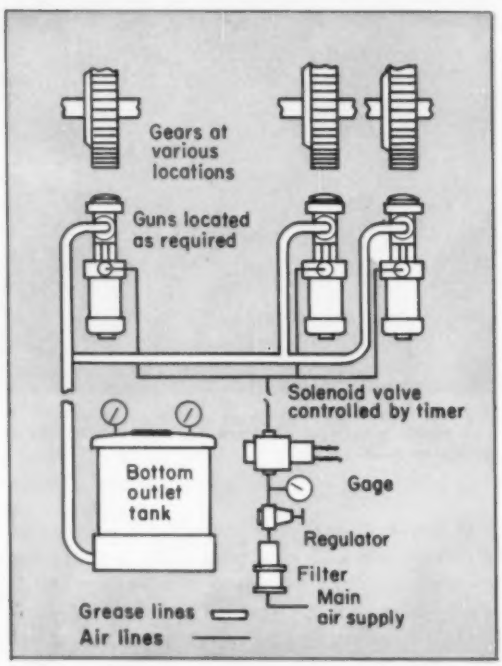


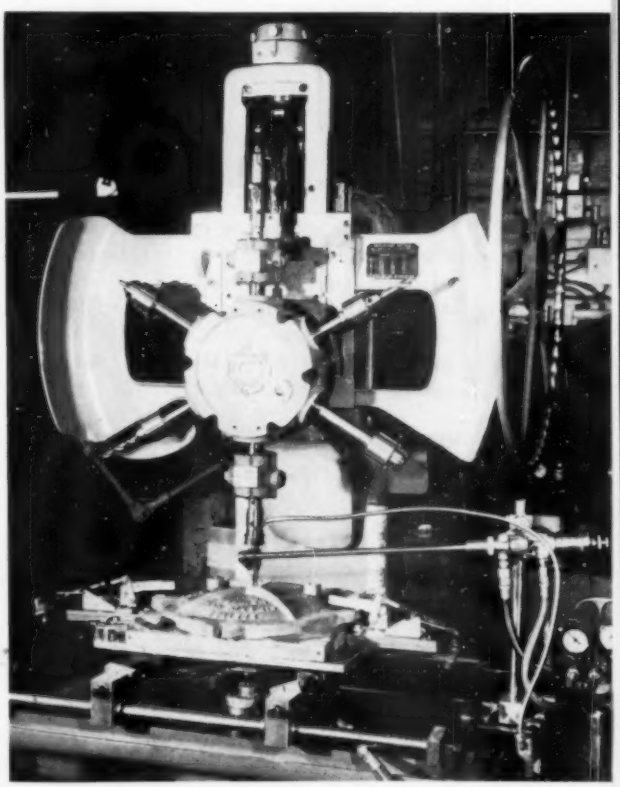
Fig. 2. (above) Typical automatic spray gun system for lubricating open gears. Spraying is actuated by a timer.

Fig. 3. (right) Standard spray gun applies lubricant to tap on a turret type drill press.

Automatic Spray Methods: After manual spraying proved successful, it was only natural that automatic spray guns, would be considered. Such guns are basically the same as hand guns except that integral cylinders are used to open the fluid plunger and air valve for spraying. These cylinders can be operated by any type of three-way air valve. Such a valve can be controlled by the operator, by timers or by cams synchronized with the parts being lubricated. A timer-controlled system for spraying open gears is shown in *Fig.* 2.

One advantage of automatic over manual spraying is that automatic guns can be readily mounted in virtually inaccessible places and tied in with a sequence or any timing system so that the parts will be sprayed at the desired time. It is usual on such installations to feed air and fluid to several guns from remote locations.

Similar money-saving installations can be made in practically every case where lubrication is required. Semiautomatic lubrication of tools in a turret head drill press are illustrated in *Fig.* 3. A standard automatic spray gun is fitted with a long extension, placing the nozzle close to the tool. Lubricant is fed to this gun from the small tank unit shown at the right of the illustration. The tube above the spray gun extension is used to automatically blow air so that chips will be cleared away from the work prior to tapping. To operate



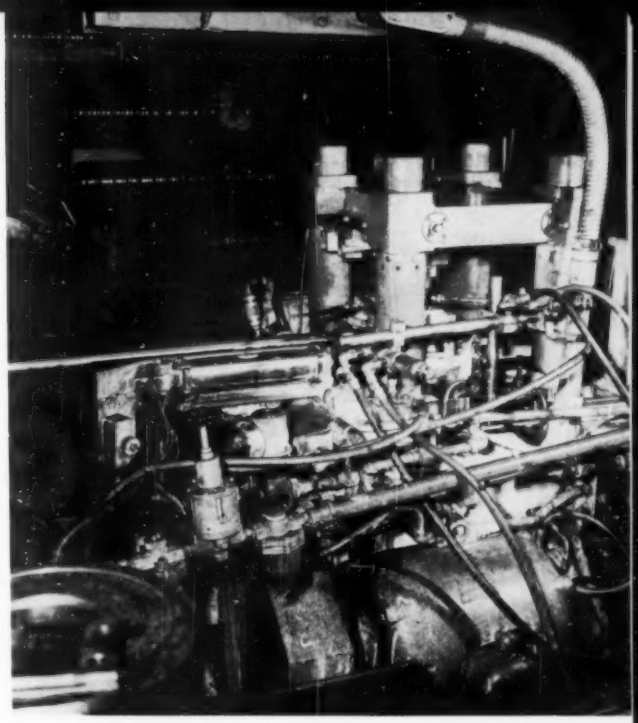


Fig. 4 (right) Automatic spray guns apply lubricant to blade of flying cutoff shear at each stroke.

the lubricant system, the drill press operator momentarily depresses a foot pedal. This causes air to blow through the copper tube pushing away all chips from the drill area. As the foot pedal is released the air is automatically shut off and the spray gun goes into action. Length of the spraying cycle, and hence the amount of lubricant, is controlled by a synchronous motor timer. Although the spray unit could be easily tied in with the drilling unit for fully automatic operation, it was found to be preferable to leave it under the control of the operator. He can apply whatever air blast is necessary to remove the chips and can position each tool in front of the spray gun irrespective of the length of tool projection from each spindle.

Two automatic guns, *Fig.* 4, lubricate a flying cutoff-blade on a tube rolling mill. Previously, this operation was manual, with the mill operator swabbing a cutting compound onto one side of the blade every time he had an opportunity. Lubrication was often neglected and the blades were rapidly dulled and would frequently catch in a tube, drawing it up into the die set and causing a mill stoppage. The manual application was also objectionable because if excess lubricant was applied it would adhere to the tube, making an additional cleaning operation necessary.

In the present installation, lubricant is sprayed on both sides of the blades at the cutting edge, *Fig.* 5. The guns are fed from a five-gallon pressure tank, control of the guns being through a solenoid three-way valve. In some cases the control includes a stepping relay, which may be set so that the guns spray on every third or fourth pass of the cutter blade. The length of time that the guns spray is determined by the setting on a dial type timer. This enables the mill operator to easily select the amount of oil required for various sizes of tubing.

A special lubricating unit, *Fig.* 6, is used to apply a heavily graphited drawing compound to a forging press. There is only approximately 5 inches clearance when the press is open and a fixed gun cannot be left in position. The compound is so viscous that it could not be handled by the average standard spray gun. The previous method of appli-

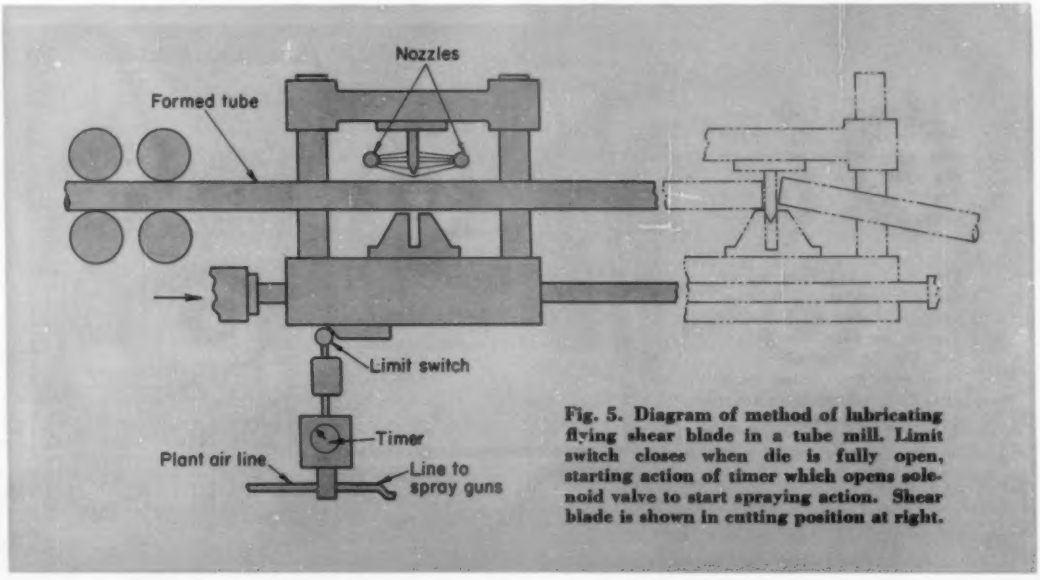


Fig. 5. Diagram of method of lubricating flying shear blade in a tube mill. Limit switch closes when die is fully open, starting action of timer which opens solenoid valve to start spraying action. Shear blade is shown in cutting position at right.

cation was for the press operator to dab compound on the face of the die with a stick. This resulted in an extreme excess of lubricant which would continually burn and which did not give the desired results.

The present lubricating unit carries two special heavy-duty guns fitted with right-angle extensions. As soon as the press clears, an air-operated carriage places the two extensions between the dies so that they come to rest over twin cavities in the forging die. Both guns then apply a spurt of fluid and withdraw. Safety devices prevent the press from operating while the guns are in the die area. Also, the gun carriage cannot move forward until the press has cleared. Automatic spray lubrication has resulted in much better die life and cleaner forgings. The lubricant is also applied evenly in the deep recesses of the die.

The interior of the type of packaged control unit used on such an application is shown in *Fig.* 7. The control provides for sequenced operation of four air valves which in turn control a cylinder to insert the extensions, turn on the atomizing air, and turn on each spray gun. Such a packaged control unit is easily installed because it only requires power supply and air connections to the valve manifold.

Design Requirements: The design requirements of any automatic spray system may be summarized as follows:

1. Foolproof controls which are easily adjusted
2. Dependable equipment
3. A sprayable type of lubricant
4. Correct design of control equipment
5. Careful consideration as to the placement of guns and auxiliary equipment
6. A flexible system which may be readily installed or moved for placement on other equipment requiring lubrication.

All of these requirements can be satisfied by use of standard spray equipment. Substantial savings are being obtained and many lubricant suppliers are formulating compounds for spray application.

Although automatic spraying of many different substances is not new, the acceptance of the fact that such installations can be made by practically any maintenance crew is still new enough to industry that some are overlooking this simple method of improving quality and lowering costs. A conscientious investigation of the possibilities will reveal potential uses for many operations.

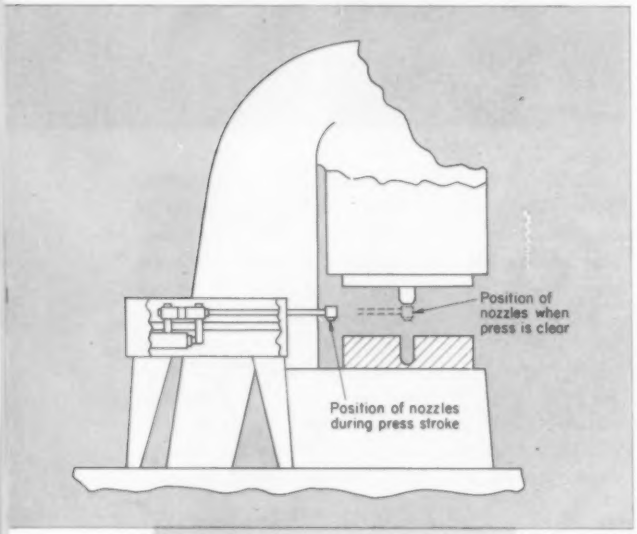


Fig. 6. (above) Forge press lubricating device. Nozzles ride on carriage and enter die when it is fully open, directing spray of drawing compound directly into die cavity.

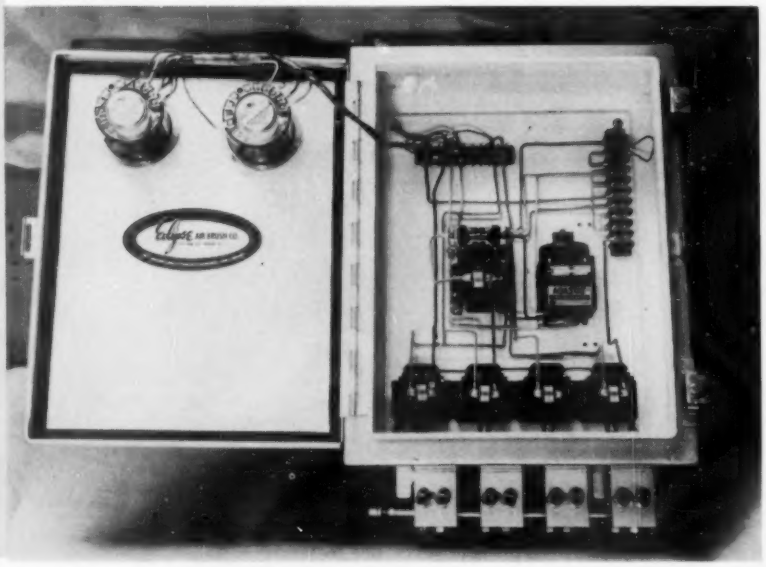


Fig. 7. (right) Interior of control unit used for forge press lubricating device. Timers on door can be set for the length of spray time required from each gun. Cabinet contains solenoid-operated valves.

basic rules for grinding
cemented carbides

By F. J. Lennon
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Although the principles expressed in this article are especially applicable to tool grinding, probably the most common operation, they are equally important in achieving success in processing any type of carbide part.

SUCCESSFUL CARBIDE GRINDING can be accomplished most readily by giving proper consideration to several basic principles that are often overlooked or disregarded. In grinding operations, particularly those involving diamond wheels, wheel mounting, wheel runout and spindle stiffness are important.

In the original mounting, alignment should be within 0.002 inch on cup wheels and frequent checks should be made during the wheel life. Straight wheels used for periphery grinding should be mounted within 0.0005 inch total indicator reading. Vitrified bonded wheels should be held even closer wherever possible.

Runout on any wheel causes rapid and uneven wear, produces poor finishes, increases bearing loads and, due to variable wheel pressures, may cause heat checks on ground surfaces. On many grinders mounting of the wheel can be done on a wheel adapter, reducing setup time by eliminating truing of the wheel each time it is used. All wheels, however, require accurate final truing to eliminate runout.

With a diamond wheel, the use of soft steel or special friction dressers utilizing silicon carbide wheels is usually satisfactory. Care must be exercised, however, not to overdress as this reduces wheel life and increases grinding costs.

Cup wheels, D6 WHC type, which have been worn out of true or grooved from improper wear distribution are trued by removing the wheel from the machine and lapping the grinding face flat on a piece of plate glass, using a water paste of 120 to 180-grit silicon carbide. A flat and true surface can readily be obtained by this method.

During grinding, diamond wheels tend to load up and require cleaning to maintain a satisfactory cutting condition. Resinoid wheels are cleaned with lump pumice or a very fine silicon carbide stick (320 grit). Vitrified or metal bond wheels are cleaned with a silicon carbide stick of about the same grit size as that of the wheel itself.

Frequently overlooked is the part coolant plays in reducing the amount of wheel dressing required, *Fig.* 1. Sticky, greasy coolants increase loading of a diamond wheel face while proper coolants do a good cleaning job, eliminating wheel waste caused by frequent dressing. Actual grinding tests show that the rate of diamond wheel life improves 2:1 when a poor coolant is replaced with one suitable for diamond grinding.

Dry grinding of carbide is unsound economy. The carbide tool may be heat checked or cracked, reducing its effective life. Also, bond of the diamond

wheel may be weakened or ruined by excessive heating, reducing wheel life. A resinoid bonded diamond wheel will last virtually twice as long on carbide grinding if an ample flow of coolant is used. There is no substitute method that does as well as a good flow of liquid coolant. Mist applicators are, undoubtedly, an improvement over dry grinding and should be used where conditions prohibit the application of liquid. Moreover, cooling tests with carbon dioxide have indicated it will do no more than a liberal flow of liquid and CO_2 is more expensive.

In grinding with silicon carbide, an effective and simple way to feed coolant to the working area is by the "coolant-through-the wheel" principle. Cooling is more effective with this method. A harder grade of wheel can then be substituted, resulting in cost savings through longer wheel life.

In diamond grinding, it is important to use the coarsest grit that will provide an acceptable finish. Under normal operating conditions, the finer the grit, the shorter the wheel life. Of course, fine finishes are often necessary to meet specific operating conditions.

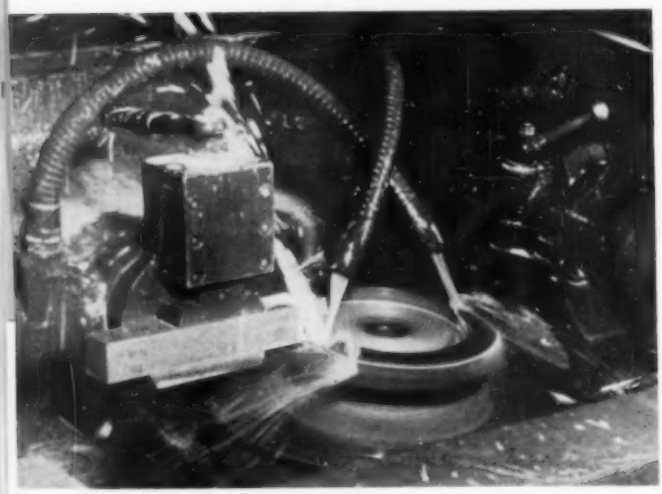


Fig. 1. (above) Grinding single-point tool on diamond wheel with copious flow of proper coolant. Use of ample coolant is important for optimum wheel wear.

Diamond wheel concentrations should be considered in establishing economical practices. Tests show that for freehand grinding, a 50 percent concentration in vitrified or resinoid bonded diamond wheels is more economical than the same wheel with a 100 percent concentration of diamonds. Metal bond wheels are more economical in 100 percent concentrations for freehand grinding.

For fixed feed grinding, such as surface, cylindrical or internal grinding with diamond wheels, 100 percent concentrations prove more efficient than lower concentrations. Whether to use resinoid, vitrified or metal bonded diamond wheels is no easy question to answer. Tests should be made for specific applications to determine the most economical bond. Among other factors, wheel and labor costs must be evaluated before arriving at a conclusion.

Since diamond wheels vary considerably, a program of wheel evaluation should also be undertaken to determine the wheel best suited for a specific job. This is a continuing problem because of product improvements. Standards of performance must be known for a true comparison of performance.

Proper design of parts is sometimes overlooked in the search for more economical grinding procedures. Too often parts are designed that require grinding of carbide and steel surfaces together. Such an operation tends to wear away a diamond wheel from four to seven times faster than when carbide is ground alone.

Also, consideration of grinding jigs and blocks often pays dividends in reducing grinding costs. Some difficult jobs are simplified merely by use of a jig. Many standard boring tools require a side relief angle different from the end relief angle. In grinding such tools, the table should be set at a greater angle with the tool on a wedge block to compensate the difference. For example, a boring tool might be ground with a 6-deg side cutting angle and a 3-deg end cutting angle. A blended radius is obtained with the table at 6 deg and using a 3-deg wedge block.

A common carbide grinding problem involves

Check List for Grinding Carbide

1. Examine possibilities of throw-away button type tools
2. Evaluate grinding wheels for specific job
3. Make choice of resinoid, vitrified or metal bonded wheels
4. Establish wheel alignment
5. True wheel to eliminate runout
6. Check spindle rigidity
7. Clean wheel for satisfactory cutting
8. Select proper coolant for optimum wear
9. Study design for best grinding procedure
10. Decide whether multiple or single pass method is to be used.

the regrinding of dulled and, in some cases, damaged tools. The normal procedure calls for rough grinding the supporting steel, using aluminum oxide wheels. Rough grinding the carbide on coarse-grit silicon carbide wheels follows and, finally, the carbide is finish ground by diamond wheels. Damaged tools present other problems. Rough milling of supporting steel is sometimes less expensive than rough grinding. Heating the tool to loosen the braze and moving the tips ahead also reduces the amount of grinding needed. Another possibility is to reverse the tip in the tool, putting the damaged section into the pocket or recess.

In chip breaker grinding, multiple pass grinding requires passing of the wheel completely through the tip, while, in single pass grinding, the length of the chip breaker is only slightly longer than the depth of the cut, *Fig.* 2. This can be a factor in reducing chip breaker grinding costs.

Effective carbide grinding is accomplished best on equipment and machines designed for this type of work. Although carbide grinding with diamond wheels involves heavy bearing loads in machine spindles, much of this work is done on light, underpowered equipment inadequate for the job. This is particularly true in offhand grinding operations where diamond wheels are often more costly than the machines themselves. In a short time bearings are worn, causing runout and misalignment; drive motors are too small, resulting in slowing down of wheel speeds.

Why the continued use of diamond wheels for carbide grinding? The answer is again one of economics. In recent years important work has been done on substitute methods. Silicon carbide wheels, which were used exclusively for carbide grinding when cemented compositions were first introduced, are available and do a satisfactory job. Usually, silicon carbide grinding will prove more expensive than diamond grinding, particularly where large surfaces are ground or close tolerences held.

Electrolytic grinding will do a good job of grinding carbide, conserving diamonds. High initial cost of equipment is a factor retarding acceptance of this method. More field testing and development is required to expand its versatility.

Electrodischarge methods, such as the Elox principle, also do a good job of carbide finishing. Work can be done on carbides by this method that is uneconomical in any other way. Again, high equipment cost reduces the number of potential users and retards over-all development. Ultrasonic machines and abrasive belt finishing are other developments that have practical advantages and can be used successfully.

Diamond grinding, however, is still the most economical and simplest method. Other methods received great impetus during early development because of the shortage of industrial diamonds. Current diamond supplies are ample and the real incentive to develop and apply substitutes is lacking. Any future shortages in diamond supplies will, in all probability, result in another surge in development of other methods.

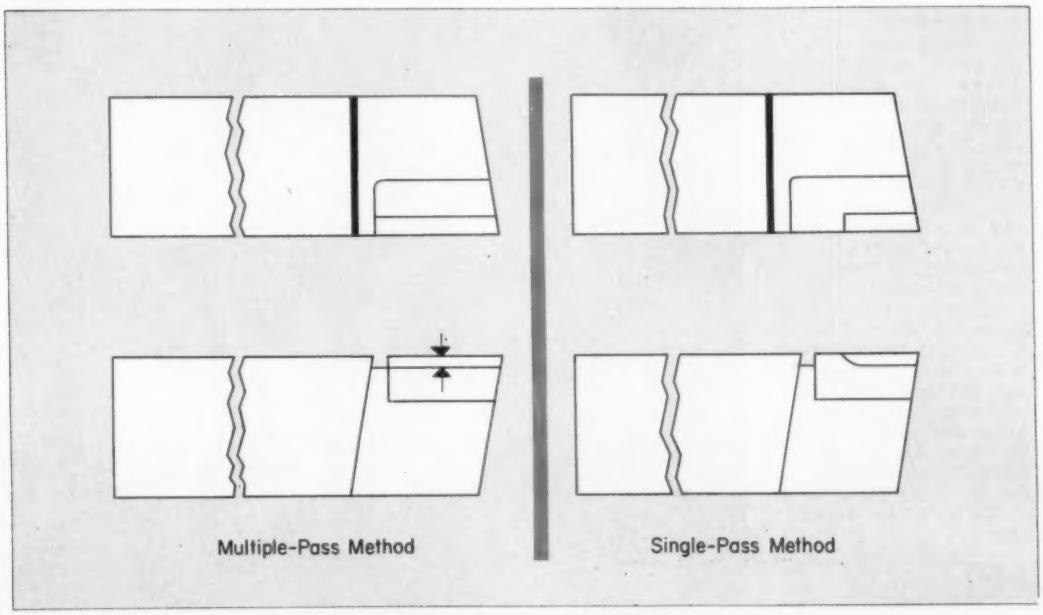


Fig. 2. Two methods of grinding chip breakers; single-pass method, where practicable, affords considerable economy.

designed for

PRODUCTION

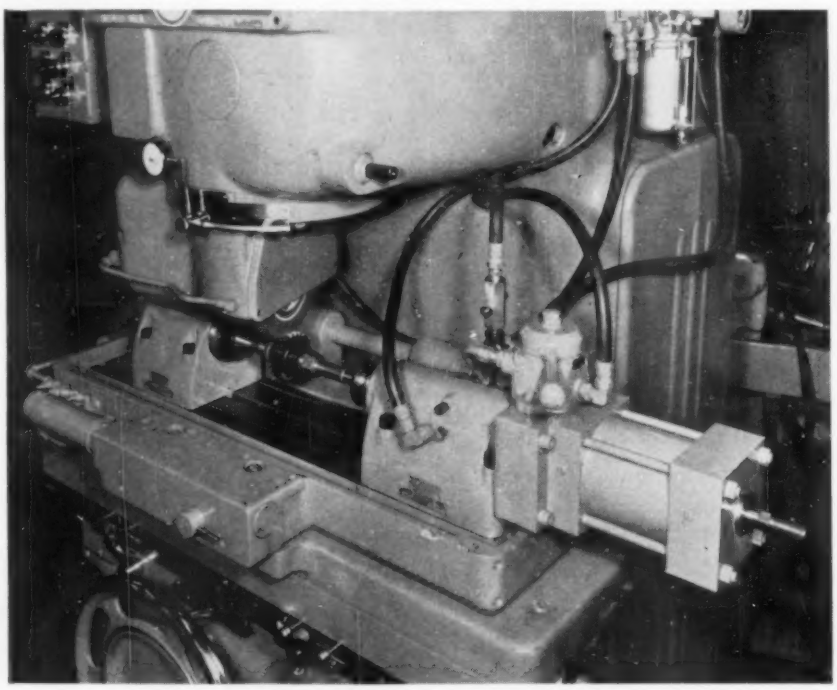
GEAR TOOTH HONING

reduces noise of hardened gears

Honing of hardened spur or helical gears, to reduce sound levels, remove nicks and burrs, correct small heat treatment errors in spacing, profile, lead or eccentricity, and improve surface finish, is now possible. Gear teeth are hobbed or shaped while soft, then hardened and honed. The honing cycle time is about one minute with expendable gear-shaped honing tools and special machines, both developed and produced by National Broach & Machine Co.

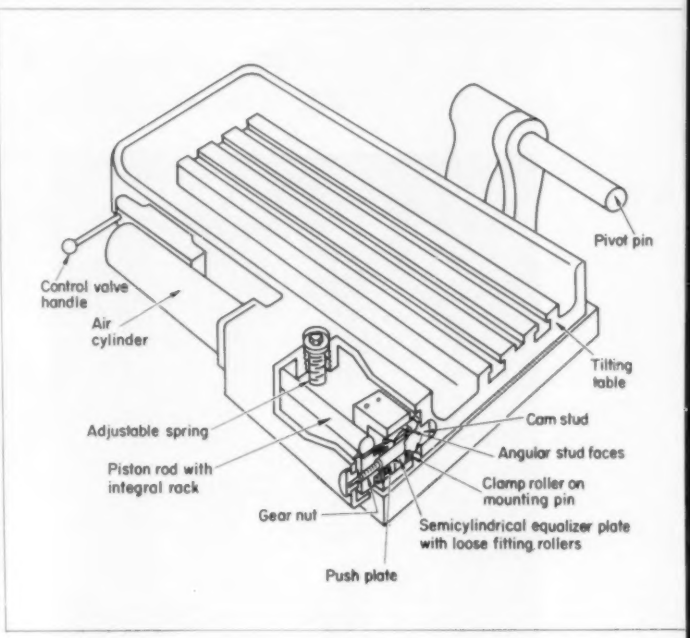
Small pinions are rotated at the limit of the machine, about 3000 rpm. Large gears are honed at speeds corresponding to about 1000 sfpm at the pitchline, without considering the effect of sliding. The equipment is designed to remove a maximum of 0.002 inch of metal, measured over pins. The honing action is one of generation.

There are two basic honing methods at this time, each with special characteristics and uses. One method, low-backlash with or without brake loading, improves sound characteristics by removing nicks and burrs, making minor tooth corrections and improving surface finish. The other method, zero backlash and controlled loading, is used where larger tooth error corrections are anticipated. Experience will dictate when each should be used.

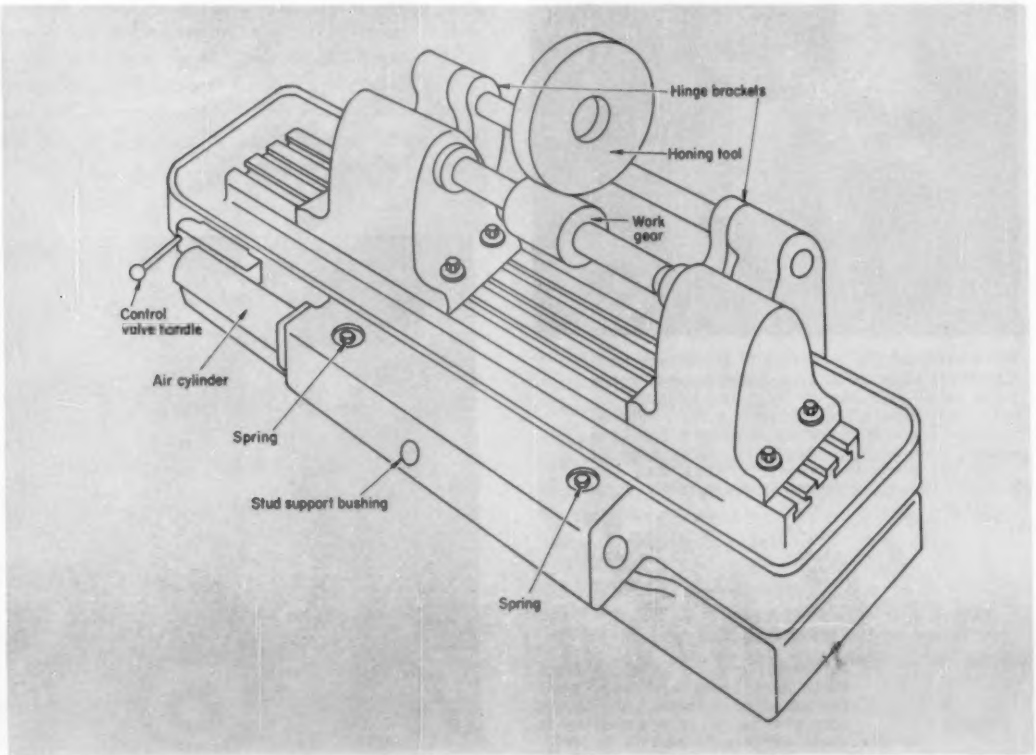


HONING TOOLS are abrasive-impregnated plastic gears, upper, that drive the hardened gear at high speed in crossed axes relationship. The work gear is traversed back and forth across the honing tool parallel with its own axis. Rotation of the meshed gears is reversed during honing. Tailstock operation is controlled by the manual air valve on the air cylinder. Tilting of the worktable, for loading and unloading, is controlled by an air valve and cylinder at the left side of the table. Hinge mounting for the tilting table is visible behind the work gear.

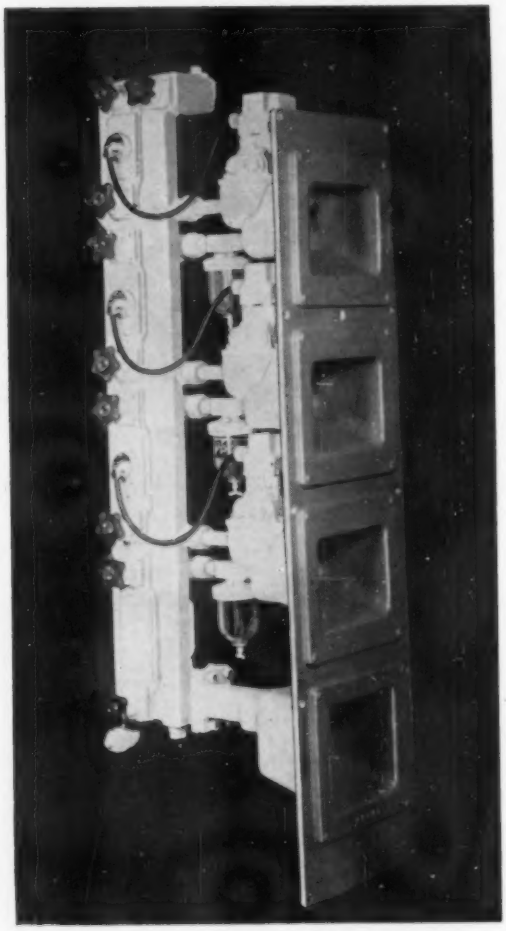
MECHANISM for lowering, locating and locking at zero backlash. When the air cylinder piston moves to the left, the integral rack turns the thread-mounted gear nut, which causes it to back off and unlock the cam stud and clamp roller arrangement. The push plate, which is pinned to the gear nut, also rotates. Because it is eccentrically mounted, the push plate, which bears on a U-shaped bracket attached to the main table, causes the auxiliary table to tilt downward. When the piston rod moves to the right, the mechanism is reversed and the springs push tilting table up. Further turns of the gear nut in this direction cause the push plate to move the equalizer axially. The table is locked by the wedging action of the clamp rollers between the surfaces of the U-shaped bracket and the cam stud. The table can be locked in central position for honing under backlash conditions with brake loading.



ZERO BACKLASH operation of one machine is achieved by a patented hinged table and a locking arrangement. Head and tailstocks are mounted on the table, which pivots at the back. The table is raised, to mesh the work gear and tool, by adjustable springs between the main and tilting tables. The table is lowered by an air cylinder. With the work gear between centers, the springs raise the table to provide a zero backlash position and the desired spring loading. The table is locked in this position during honing.



Press Design Anticipates Use of Auxiliaries

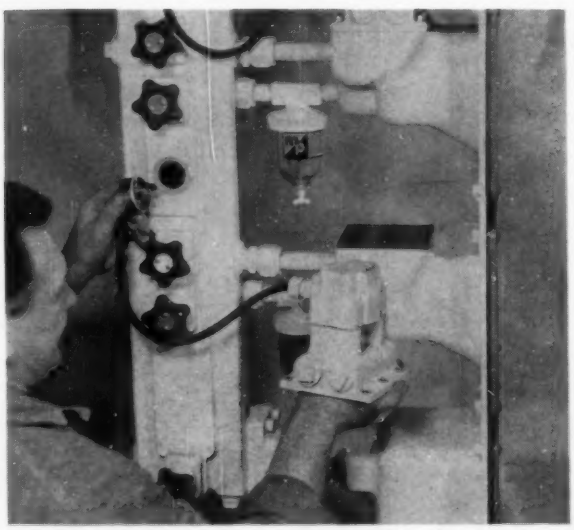


MAIN BODY of the manifold is a high-strength aluminum alloy casting. A honeycomb of cored ports forms both the air inlet and exhaust circuits, and oil-tight compartments for electrical wiring. Weir type valves are used for both shutoff and exhaust functions. This type of valve has good flow characteristics, and has long life because it uses neither seats nor stem packings.

IN recent years, more auxiliary equipment, such as coil feeders, unloaders, die lifters and stock dopers, has been used in conjunction with power presses. Operation of this equipment depends on solenoid-controlled line air pressure. To get rid of the clutter of pipes, fittings and power lines, this manifold has been developed by Clearing Machine Corp. Installation of auxiliary equipment is easy because only two air connections are required, one air inlet and one exhaust. The only other devices needed to automatically operate auxiliaries are adjustable, rotary cam limit switches and timing relays.

This unit is mounted in a separate compartment in the press frame. Press air controls, which require adjustable pressure, are in an adjacent compartment. Separation of these two types of controls simplifies the air system and adds a safety factor.

Exhausts from normal operation of the solenoid valves are directed to a single port at the bottom of the manifold. They are then piped to an air silencer located in a lower compartment of the press, or they may be piped to a basement. In this way, the control compartment is kept free of oily exhausts and noise is reduced.



SOLENOIDS can be unbolted from their cast bases and unplugged for complete removal. Lubricators may also be easily removed from their adapter blocks.

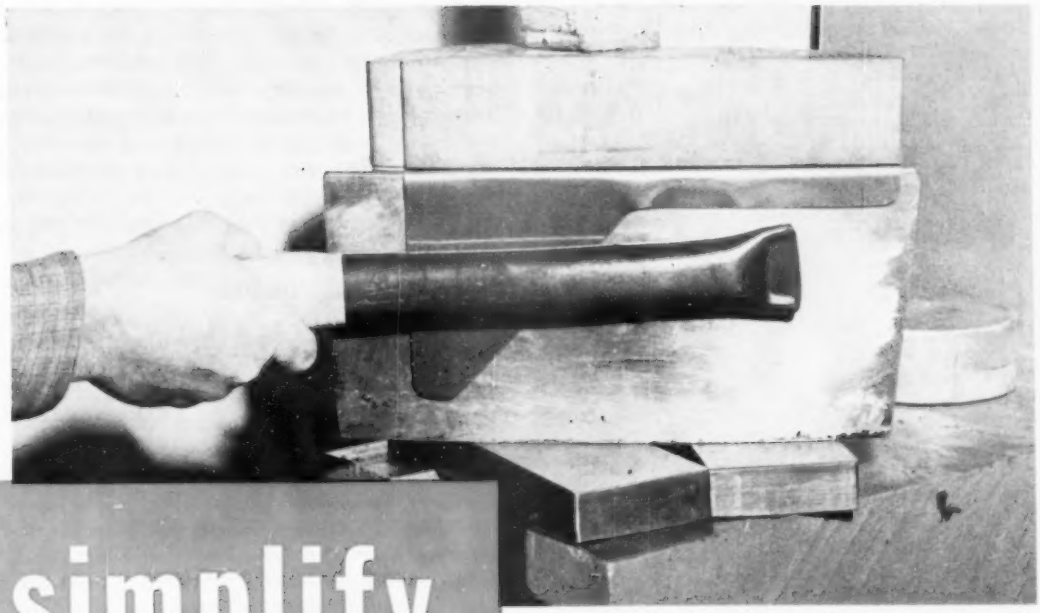


Fig. 1. Sealed shot-filled plastic tube is used to work down flange bulges after hydropress forming of aluminum part.

simplify tooling

for short-run economy

By Leonard Mueller*

Process Engineer
National Presto Industries, Inc.
Eau Claire, Wis.

In this age of automation is there still a place for the small firm that can move rapidly to meet changing conditions? The answer is yes, if it can maintain its efficiency and hold costs down. This article describes some tested methods for achieving those goals, which are widely applicable.

MANY SMALL SHOPS, however efficient, can scarcely hope to set up for truly automatic production because their operations deal with limited quantities, scheduled at infrequent intervals, or single-lot runs. These concerns have come to realize that complex, expensive tooling lying idle in a storage area can be a poor investment, also that competitors may underbid them because such competition has learned to use simpler, less costly tools. Therefore, in this situation, any device which can reduce tooling cost without an excessive increase in production time is usually well worth while.

This does not mean that crude tooling is practical but rather that some types of tooling are better adapted to low production quantities than others. Considerations involved in determining types and costs of tooling include:

1. The annual production rate
2. Sales life, i.e. when product will become obsolete
3. Cost of labor in both toolroom and production shop
4. Materials costs for both tooling material and product material

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5. Maintenance costs of various types of tooling
6. Setup time of one type of tool compared to others
7. Idle money invested in tooling and special factors affecting the individual shop.

By analysis of the foregoing facts, a sensible decision can be made as to the best tooling for the job at hand, which is usually the most practical, also.

The aircraft industry exemplifies the practical approach to such problems. It is unceasing in its search of ways to reduce tooling cost, since design revisions are frequent and production quantities are usually small. In similar types of operations, many ingenious money-saving ideas can be adapted, from aircraft tooling and production techniques, *Fig.* 1, to improve practicability of tool designs.

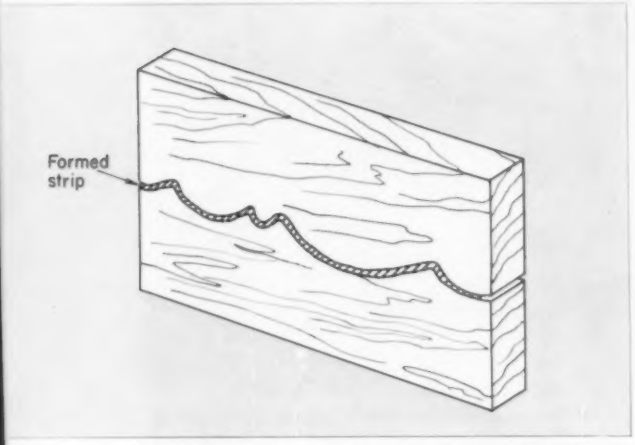


Fig. 2. Complex springback problems in forming are simplified by use of experimental profile die to check amount of springback allowance needed.

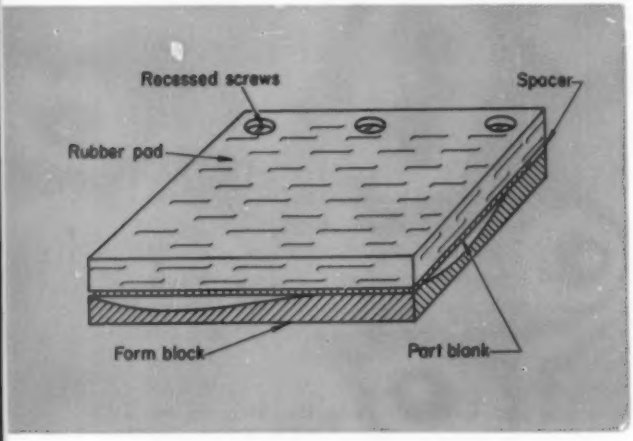


Fig. 3. Roll forming compound contours is implemented by a form-block sandwich which is passed between the rolls.

Materials Savings Possible

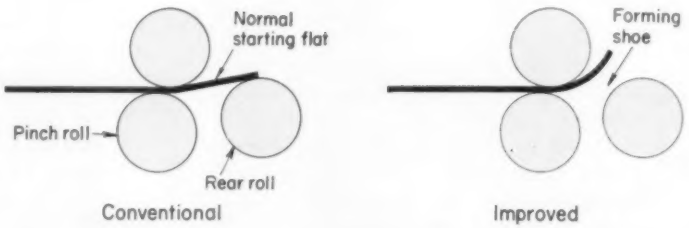
Tooling materials used in aircraft forming operations are selected for the use for which they are to be subjected and are usually inexpensive and simple to fabricate into the form desired. Often they may be easily melted and recast into new tools. Specifically, rubber, cork, hard wood, impregnated wood laminates, compressed bonded fiber, plastic materials such as polyesters, epoxies and phenolics, reinforced fiber and laminates, Cerrobend metal, hardened lead (lead antimony), Kirksite (zinc copper), aluminum, cast iron, Meehanite and lower grade steels are often used to do the job.

Recently, one aircraft company found that a considerable amount of money could be saved by casting their larger forming dies from aluminum rather than the material formerly used. Although the aluminum is more costly, its weight is approximately 66 percent less, thus a saving of $30,636 in material was realized on the first fifty-six dies so produced.

Many shops use machines such as press brakes or slower type hydraulic presses for forming small clips, angles, brackets and similar parts, without investigating the possibility of using small fast power presses or kick presses, often standing close by, which do the job more efficiently and usually at lower tooling outlay. Shop people become accustomed to associating one type of machine with forming and the other with perforating, forgetting that each machine can do certain types of work more effectively than the others.

Often in setting up forming jobs it is difficult

Fig. 4. Waste of material in starting a curve shape or cylinder or the alternative of an edge-forming operation are eliminated by use of a forming shoe as shown in the right-hand sketch.



to determine blank size because of multiple angles, varying radii and bends. A rapid, dependable method of finding the answer without use of bend allowance, set back or K-value charts is to roll or flatten solder wire to the stock thickness required or use easily formed dead soft material of the proper thickness. By finger bending to an accurate layout and carefully flattening again after forming, a close pattern of blank size can be found.

Springback, another problem which must be solved on complicated bends, usually can be readily worked out by empirical methods. This is accomplished by taking $\frac{3}{8}$ or $\frac{1}{2}$ inch wide strips of the stock and forming these strips on band-sawed $\frac{1}{2}$-inch wooden or masonite dies, *Fig.* 2, placed in a press brake, arbor press or bench vise. After a part is formed, corrections can be made in the dies as required until satisfactory strips are produced.

From the curves thus developed, dies of practically any thickness or length can be made of more durable material for production runs. A strip $\frac{3}{8}$ or $\frac{1}{2}$ inch wide of stock with grain direction running correctly will form approximately the same as a blank 10 feet long.

More Forming Short Cuts

When press capacity is limited or unavailable, compound curves (crown) can be produced with most rolls, using a form block to which is attached a rubber pad, *Fig.* 3. The form block can be made of glass cloth epoxy or phenolic laminates machined, disk ground or cast to the concavity required. To produce the part, a blank is slipped between the rubber pad and the form block and the entire sandwich is passed through the rolls. The pressure, exerted by the rolls forces the rubber and blank against the hollow face of the block causing it to take the shape desired.

In many cases, an edge-forming operation can be eliminated in rolling curves or cylinders by making up sectional forming shoes which can be slipped between the front and rear rolls on a pinch type machine, *Fig.* 4. As the work passes between the two forward rolls, it encounters the nose of the forming shoe and must bend upward in order to travel forward, thus producing the desired curvature without the loss of the large flat areas normally produced. The shoes can be made with an adjustable rear portion so that a variety of radii can be rolled, eliminating the need of a separate set for each curve.

One set of shoes so designed in two foot sections for 8-inch diameter rolls was used in rolling stainless steel cylinders varying from 14 to 30 inches in diameter. The thickness of the stock which can be rolled depends on the capacity of the rolling machine.

When short tubes, extrusions, angles and channels must be formed with a minimum of marking and flattening a practical method is as follows:

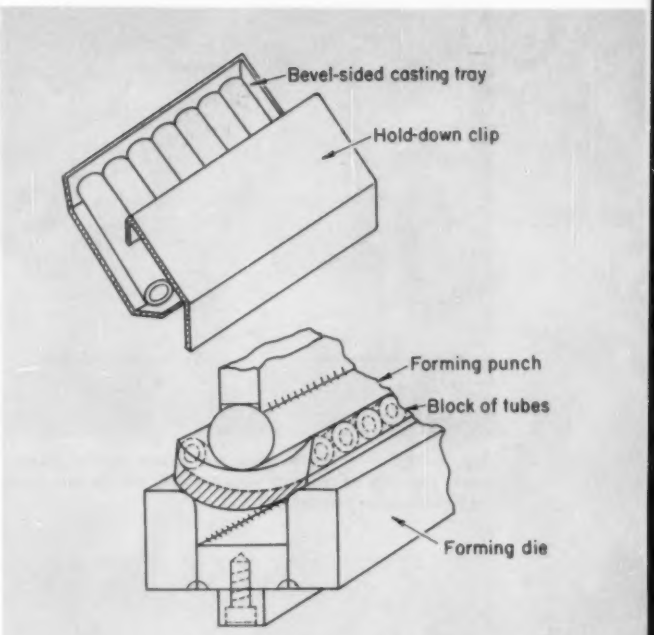


Fig. 5. Multiple forming of tubular workpieces cuts production time and improves quality when this method is employed. Piece-parts are first cast in Cerrobend metal, then formed in press brake.

> Parts are cut to final length, lightly oiled and loaded in a bevel sided sheet metal tray 12 to 20 inches long. The tray is placed on a level surface and molten Cerrobend metal is poured into the trays. The tubes must be held in contact with the bottom of the trays by a weighted clip and all trays are filled to the same depth, *Fig.* 5. After the Cerrobend has solidified, these blocks of parts can be formed to the radius required in a press with a simple punch and die. Fifty to one hundred pieces can be formed at each stroke of the press and the parts easily separated from the Cerrobend by setting the formed blocks in hot water.

The use of forming clips to reduce handwork following a Guerin operation may prove a real time saver in forming sheet metal parts with curved flanges. These clips are slipped over the edges of the part during the loading operation, *Fig.* 6. As the platen descends, forcing the clip downward, the part flange bends until the lower portion of the clip meets the bed face. The inner portion of the clip then moves downward with a wiper action producing a clean flange without wrinkles.

Another simple way to work wrinkles out of curved flanges with a minimum of springback and marking, is to finish by hand forming, using a 40-60

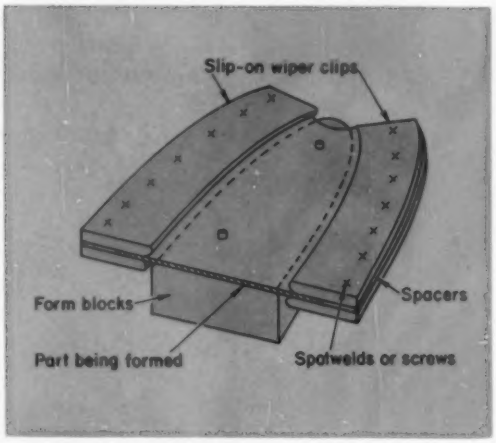


Fig. 6. Time-saving tooling for many curved-flange parts consists of slip-on wiper clips, which are used in Guerin type operations.

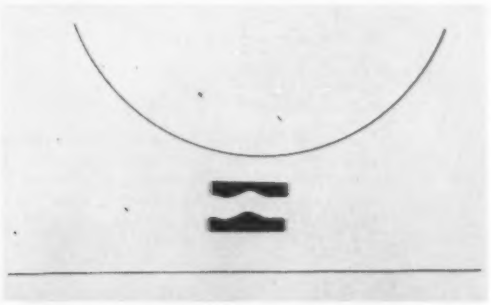


Fig. 7. Wood straightening blocks, a vise and electric drill straighten 0.081-inch stainless wire. (Top) Wire as cut from coil; (center) form blocks; (bottom) processed wire.

solder bar or a sealed shot-filled plastic tube, *Fig.* 1. Where hand forming operations are necessary, such solder-bar forming will give surprising results, reducing the time required. After the flanges have been started and brought down close to the block, a solder bar or shot tube held like a mallet, is slapped lengthwise across the bulges and wrinkles. The soft but dense solder, usually covering several wrinkles at one time, shrinks the material to the form block. Even tough stainless alloys can be formed with a minimum of work hardening.

Wire straightening problems sometimes arise when small job lots are handled. If time does not permit obtaining use of a wire straightening machine, a simple substitute can be made by band sawing a hardwood or phenolic block to the approximate curve shown in *Fig.* 7. A retaining groove is then burned or hand cut with a rotary tool along the center line of one or both curved faces to provide clearance for the wire. One end of the wire is tightly chucked in an electric hand drill and with the motor running the wire is pulled through the lubricated blocks which are clamped in a vise. The free end of the wire, which is cut to convenient lengths, should be restrained from whipping by holding it inside a tube or guide. The motor should be stopped before the free end of wire leaves the blocks.

These examples selected from typical tooling practices in aircraft and model shop practice, represent methods by which tooling costs can be minimized for short runs. They further illustrate how the ingenuity and practical experience of a firm's tool engineers can be profitably utilized to enable a small organization to maintain its place in today's increasingly competitive business conditions.

Hard-Chrome Plate Saves Boring Bar

Knowing when to depart from established techniques represents an important phase of tool engineering. Considerable value may be tied up in a workpiece when a mistake is found. It is up to the tool engineer to figure out a way to save this added value.

As a case in point, a company made a boring bar 5 inches in diameter by 72 inches long with a 12-inch-long shank. This bar had a 1-inch-square keyway running its full length. The material was SAE 4140 and the desired hardness was specified as 55-60 R_C.

Heat-treating problems were encountered because the keyway would lead to warpage. A dummy keyway was put on the opposite side of the bar to more evenly distribute quenching stresses. Also, the specified hardness was higher than SAE 4140 can normally attain in such large pieces. This was the mistake. The boring bar should have been made out of a carburizing steel, such as SAE 4615, which could have provided a hard surface and a softer core. A bar of this type could have been straightened. However, the boring bar was already made and a solution had to be found so the value already added could be saved.

The heat treaters, Industrial Steel Treating Co., Oakland, Calif., drew the hardness of the heat-treated bar to a straightenable range, about 30-35 R_C, then polished and hard-chrome plated it to provide the required surface hardness. This solution represents a means to an end rather than a recommended procedure, but points up the desirability of consultation during the design and specification of materials and parts.

Assembly Tolerance Charts save time and money

By John F. Anderson, Jr.*

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BECAUSE CLOSE tolerances are expensive to maintain, individual tolerance charts were made for every major part of the Plymouth V-8 engine. These charts showed where tolerances could be opened up, easing manufacture without adversely affecting function. After the charts were made† and adjusted for the proposed manufacturing processes, some tolerance stack-ups were found. These would have permitted the production of engine parts, *Fig.* 1, that would not be in accordance with dimensions specified on the part prints.

One of the main causes for this condition was that part-print dimensions were frequently given from a point other than the manufacturing locating point (indirect machining). Dimensions could usually be changed on the part print so they would relate the locating surface and the surface to be machined. Tolerance stack-ups would thus be prevented and the part function would not be impaired. In some instances, minor changes—change of locating surface, placing all important operations at one station of a machine, etc.—were made in manufacturing procedures so parts could be made to engineering specifications.

After these adjustments were completed, a set of manufacturing drawings was prepared from the engineering drawings and the tolerance charts. All machining and intermediate gaging dimensions can be obtained from tolerance charts, which are actually graphical representations of the material removed during each step of manufacturing a part to part-print dimensions. Machines, equipment, jigs, fixtures and gages were designed to the manufacturing drawings.

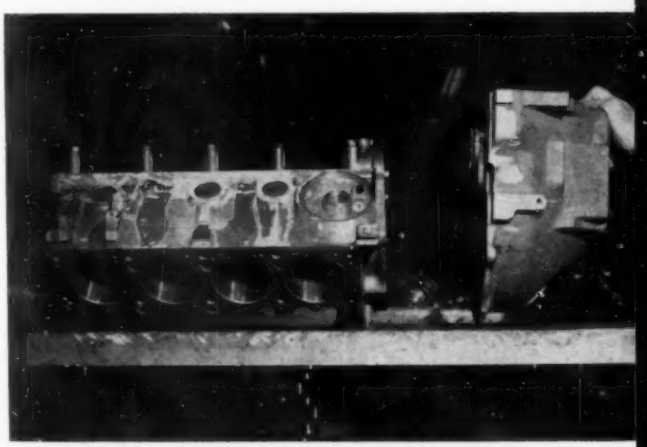

Fig. 1. Individual tolerance charts were made for this cylinder block and clutch housing prior to the pilot production run.

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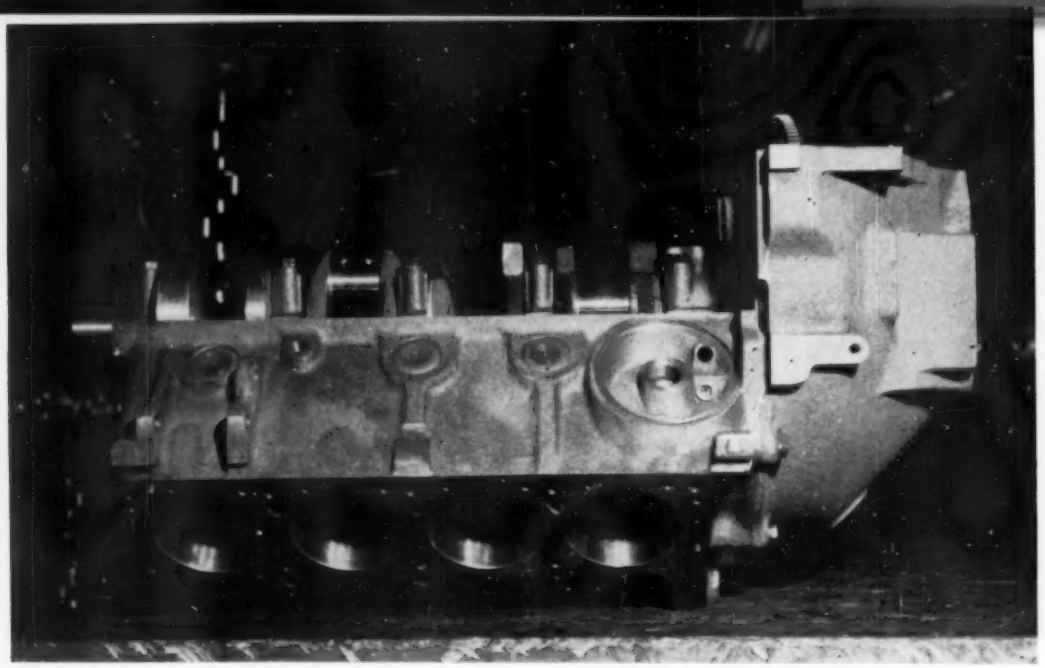
†For information on tolerance chart preparation, see THE TOOL ENGINEER, pp. 53-62 and 89, Feb. 1954 and for adjusting tolerance charts, see pp. 75-81, Oct. 1955.



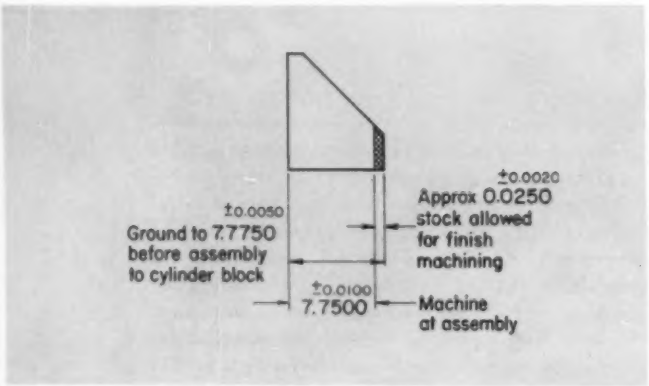
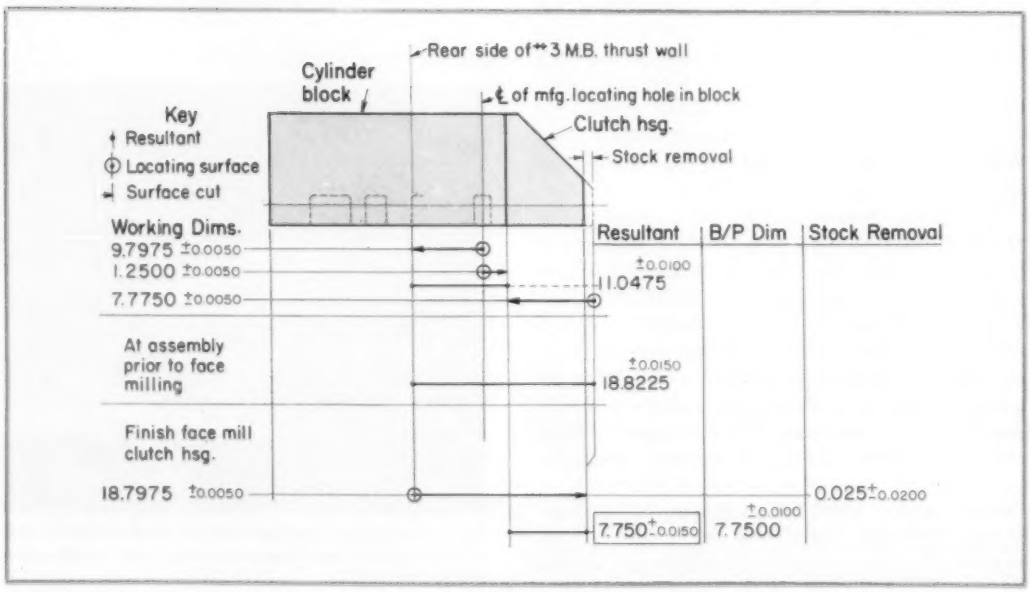


Fig. 2. (above) An assembly tolerance chart was prepared for the cylinder block and clutch housing after start of the pilot run because some of the assemblies were being produced out of tolerance.

Fig. 3. (left) Blueprint dimensions of the clutch housing, which indicate the grinding operation before assembly and the milling operation after assembly with the cylinder block.

Fig. 4. (below) Tolerance chart of the assembly showing how tolerances stack up to be larger than allowable on a blueprint. The blueprint tolerance was subsequently increased.



As with all engine development programs, it was necessary to run a pilot engine assembly operation to be sure all components fit and function as they should. Nothing can take the place of actual trial. During this pilot run, it was found that some parts that were made to the dimensions on the individual tolerance charts did not go together properly. In some instances, interference existed between mating parts. Because of this experience and to prevent assembly tolerance problems during the production run, it was decided to prepare tolerance charts on all critical assemblies.

The cylinder block and clutch housing assembly, *Fig.* 2, represents a good illustration of the utility of assembly tolerance charts. Prior to assembly, the clutch housing is ground, *Fig.* 3. After the housing is assembled to the block, the transmission face is milled. During production, this milling operation is related to the thrust face of the No. 3 main bearing wall for length, to the pan rail for height and to two crank bearing holes for twist. In machining the pilot run, it was found that a number of housings could not be milled so the transmission face would conform to the blueprint specifications, *Fig.* 3.

An assembly tolerance chart, *Fig.* 4, was made in an effort to determine what was causing the improper condition. Because the last resultant is the result of indirect machining, tolerances on the assembly machining dimension and the second resultant must add to equal the stock removal tolerance. Therefore the actual tolerance that the clutch housing could have on the length dimension after indirect machining would be ±0.0150. This is obtained by adding the tolerances of the first resultant and the indirect machining dimension. A tolerance stack-up that would permit a percentage of these assemblies to be out of tolerance was discovered. This dimension has a rectangle drawn around it in *Fig.* 4.

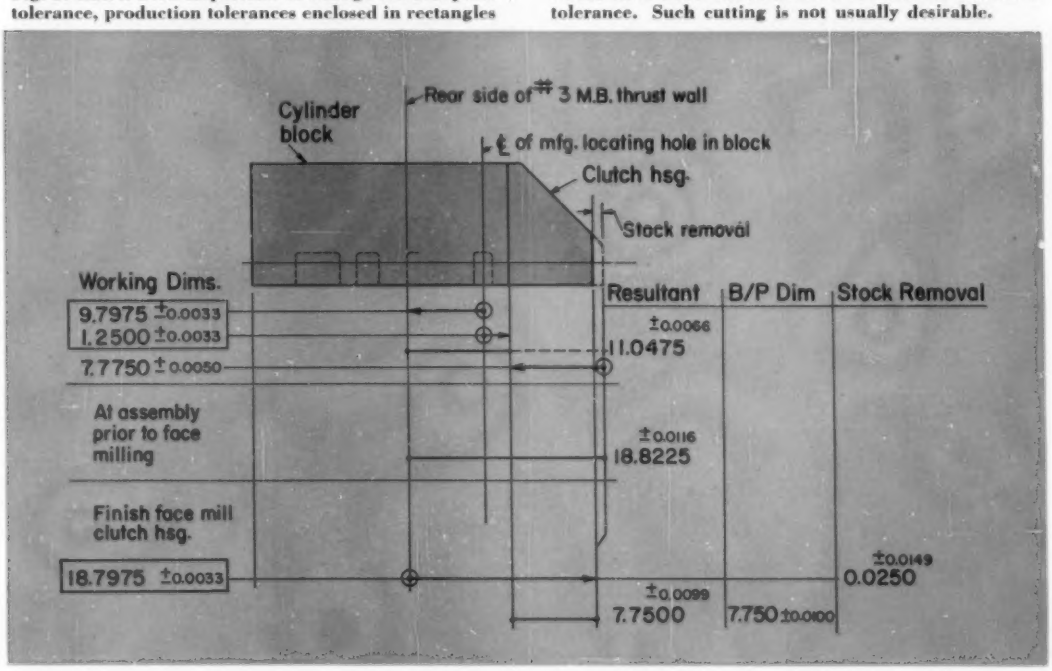
In this particular instance, solution of the problem was simple. The product engineering department was consulted and investigation showed that the tolerance for the subject dimension could be opened up to the ±0.015-inch value that could be easily achieved in production. The part-print dimension was changed accordingly.

If it has been impossible to increase the resultant dimension tolerance for this part, tolerances on earlier steps would have had to be tightened so that the assembly could be made to meet blueprint specifications. It is not desirable to tighten production tolerances because of the additional costs involved but in some instances such tightening is necessary.

The tolerance chart in *Fig.* 5 shows how such tightening would have been accomplished for the cylinder block and clutch housing assembly. By reducing the tolerances of preceding steps, the final resultant tolerance can be reduced to that required by the blueprint.

Based on this successful use of assembly tolerance charts, which materially aided the production department in producing an entirely new engine in minimum time, such techniques have become firmly established in the Engine Div., Chrysler Corp.

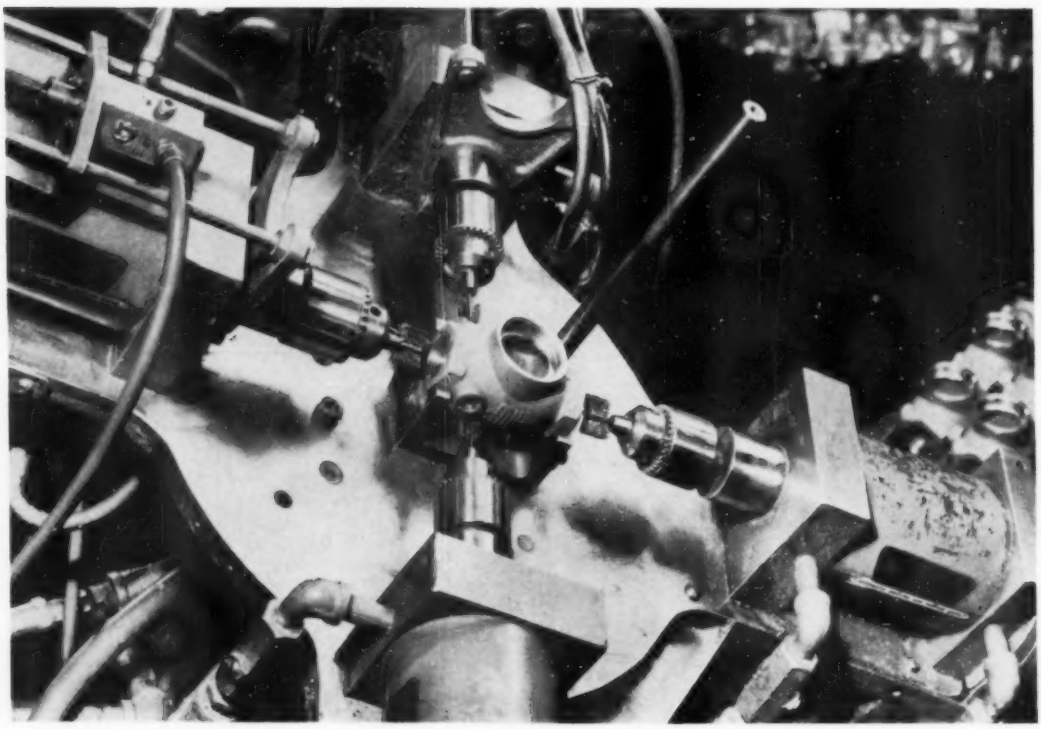
Fig. 5. Had it been impossible to change the blueprint tolerance, production tolerances enclosed in rectangles would have been cut to achieve the desired resultant tolerance. Such cutting is not usually desirable.



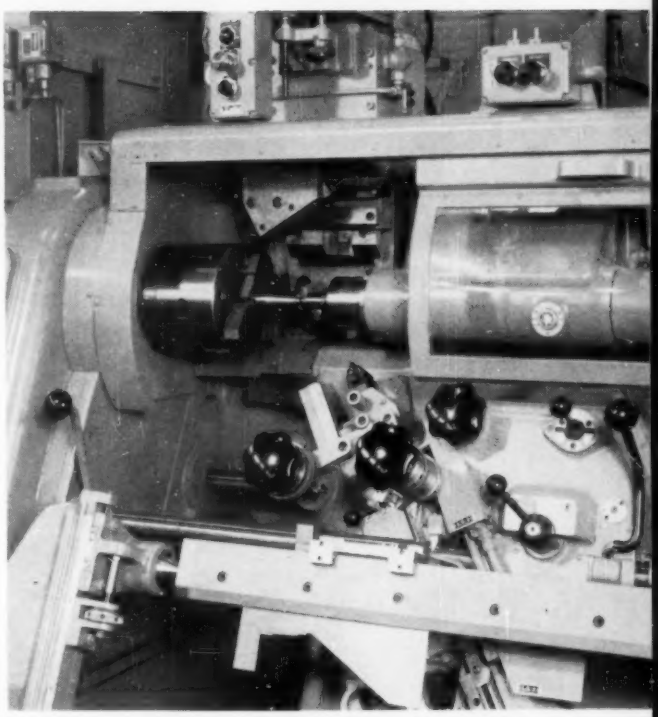
TOOLS at work

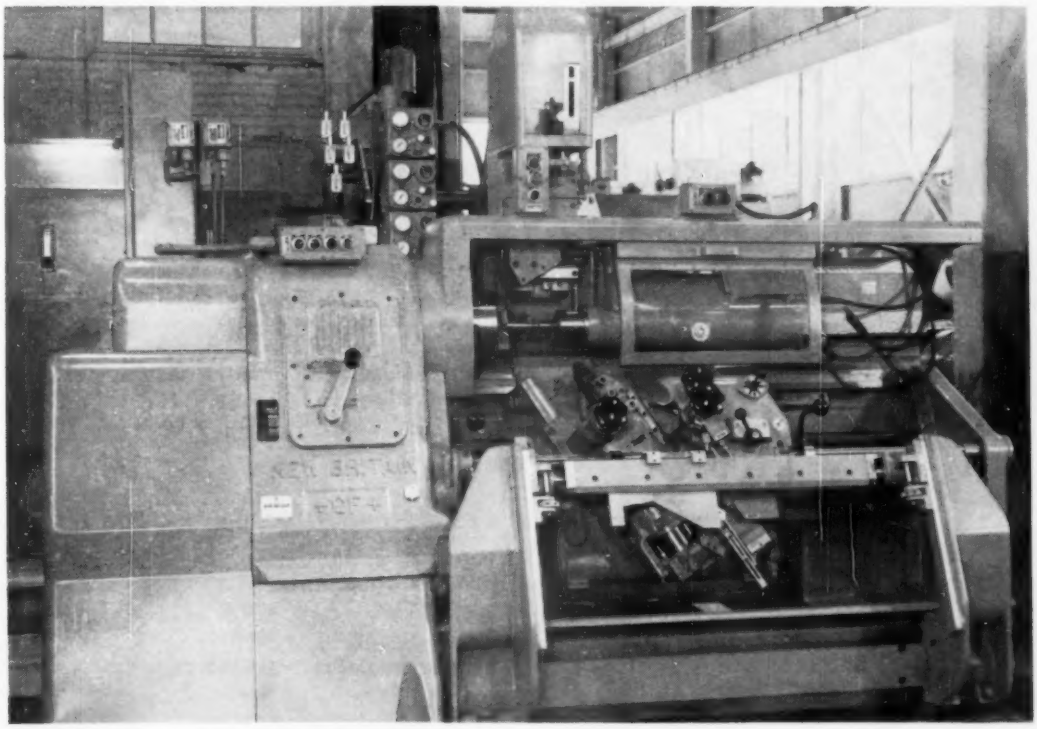
Automatic processing techniques now in use indicate a fast-moving trend in metalworking and fabricating. They disprove the frequent contention that small plants are unable to meet the challenge of automation.

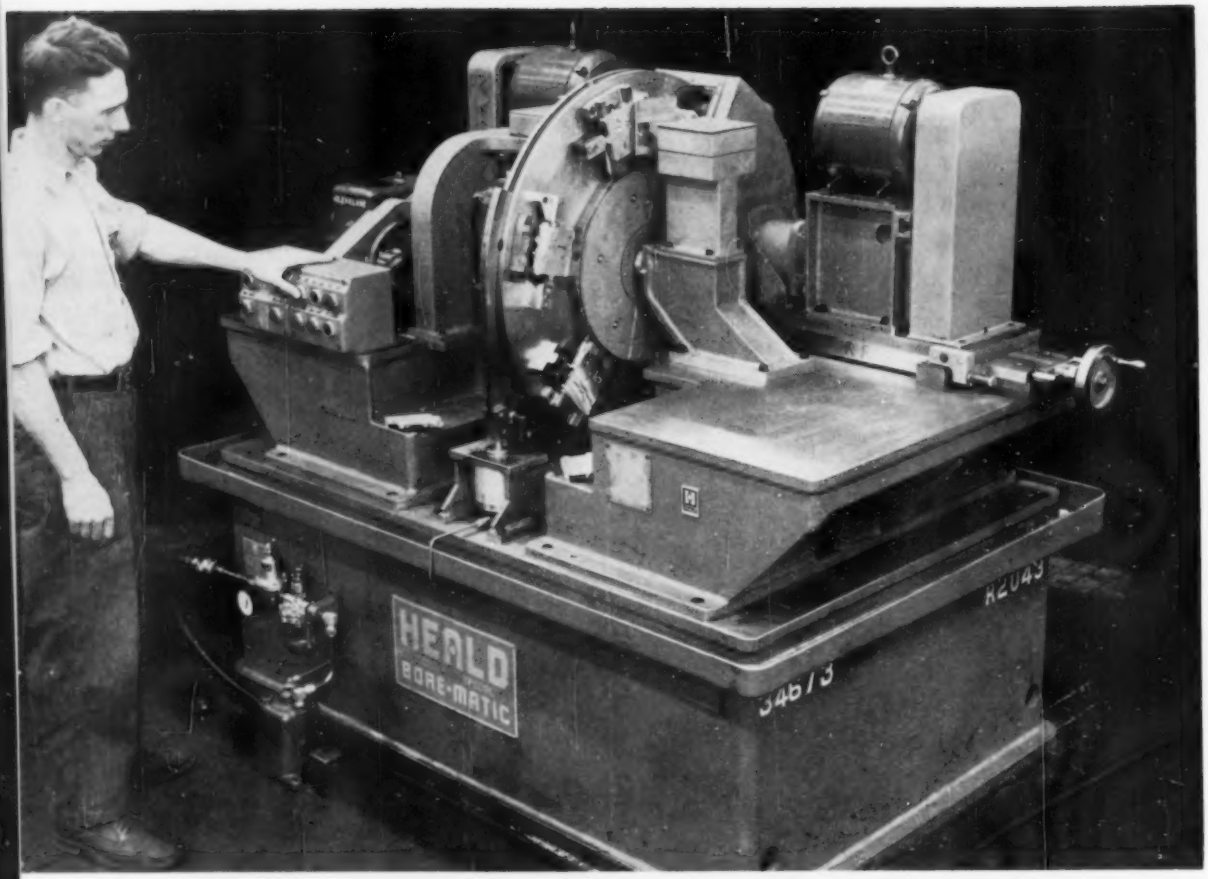
SIMPLICITY AND SPEED are keynotes in automatic finishing operation employing power brushing. Four holes in a casting are deburred 66 percent faster than by former hand methods. Operator merely loads part in the jig and presses a button to actuate the air drill motors. Results are more uniform; output is consistent; and costs are cut. Setup devised in consultation with Osborn Mfg. Co. engineers, is flexible. It can be adapted easily to other parts.



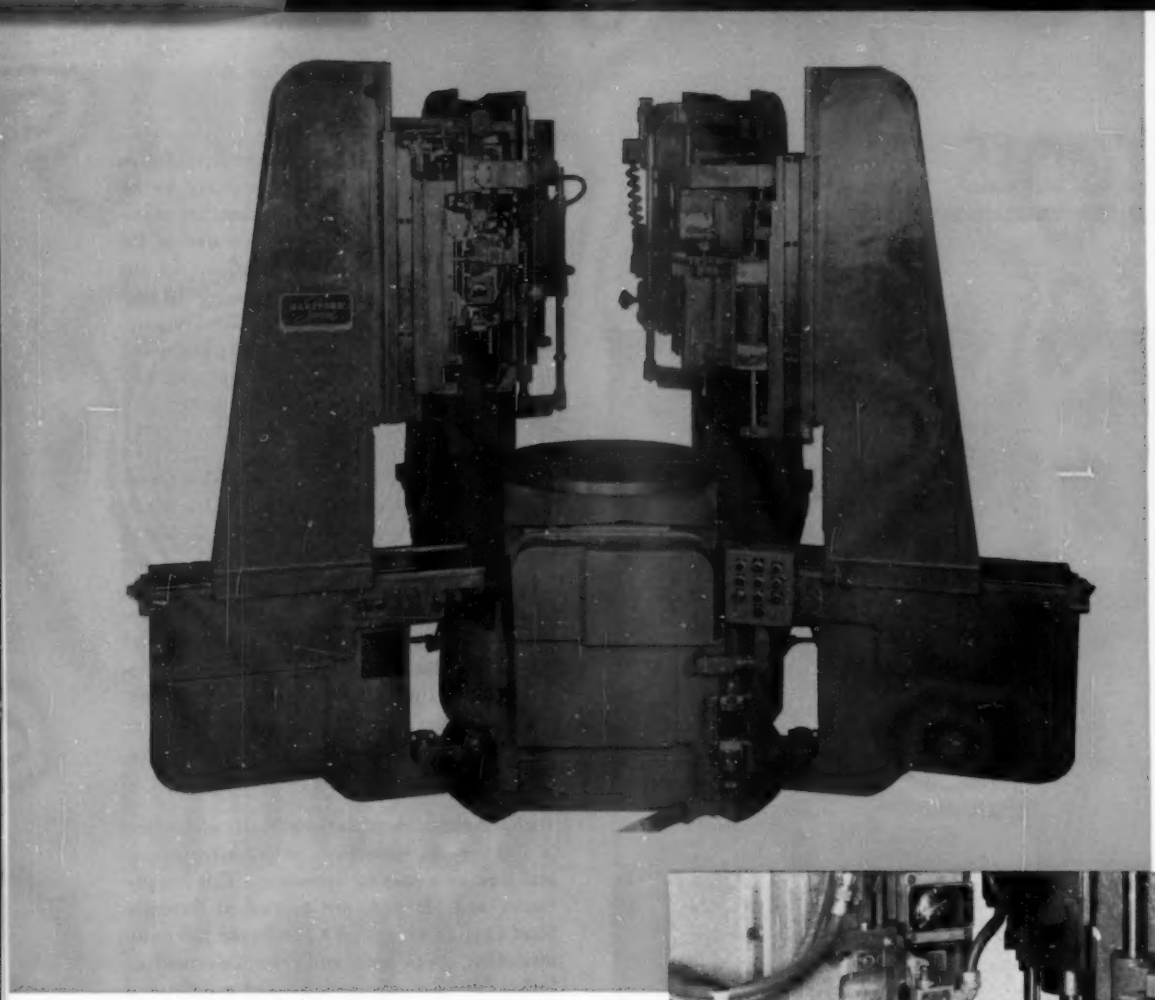
AUTOMATIC TRACER operations, shown in this multiple turning of a forged injector body, use a simple form of programming with information stored in a template or cam. The automatic work cycle for this New Britain GF copying lathe reduces floor-to-floor time to 0.80 minutes for this workpiece of 4150 steel alloy. Operations include flange facing, rough turning, stem end and taper finishing. The practical tooling (close-up) is the secret of success in this job. It is sturdy enough for production, yet simple for rapid setup.

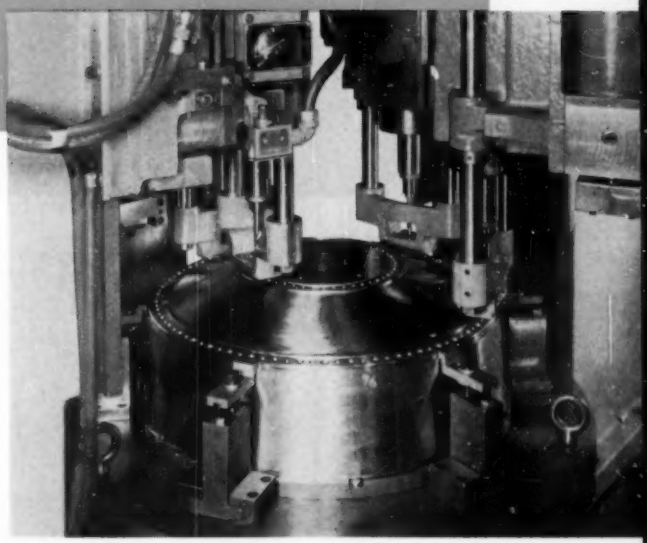






CONTINUOUS high production for precision facing of aluminum valve bodies is provided by this unusual machine with a trunnion type fixture that rotates parts into position between two opposed boring heads. With the 12-station fixture moving at ½ rpm two finished parts are produced every 20 seconds. Tooling (close-up) consists of two multiple toolholders each carrying eight single-point carbide facing tools. Operator loads and unloads parts on the fly using a foot treadle operated fixture release. This Heald machine removes 0.050 inches of stock and gives a finish of 20 microinches with excellent flatness.

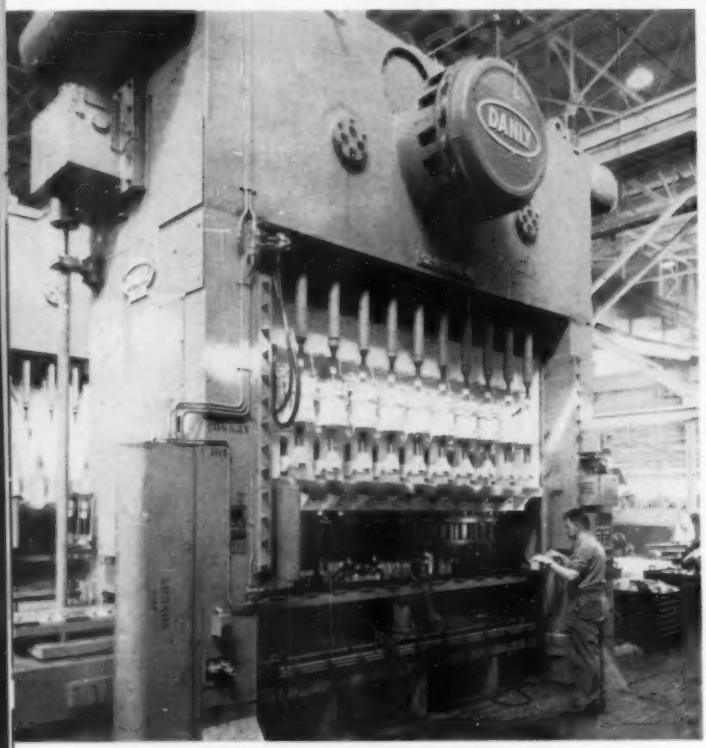




FLEXIBILITY and automaticity are combined in this universal drilling and tapping unit shown bare and set up for multiple drilling operations on two diameters (close-up). Machine was developed by Hartford Special Machinery Co. primarily for jet engine production. Circular indexing table operates on automatic cycle when part is loaded.

TOOLS at work

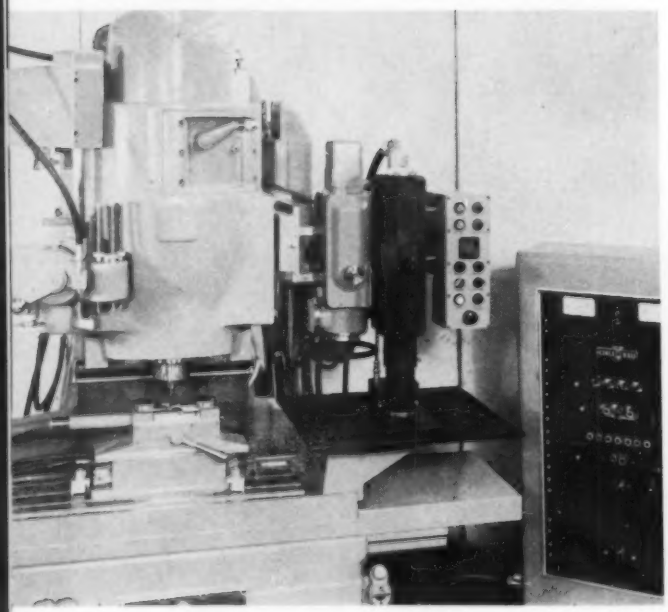
TOOLS at work



(left) AUTOMATIC transfer, often heralded as a revolutionary concept, can scarcely be regarded as something new in a familiar transfer feed press. Still, it represents one of the most efficient forms of automation. In the operation illustrated it is performing 10 separate steps in 10-stage dies. Blanks are automatically fed into this Danly press; five drawing, one trimming, two coining and two piercing operations complete the part.

(lower left) PROFILE MILLING machine traces direct from a drawing. Symbolic of a whole family of such improvements, this Cincinnati single-spindle profiler promises much of the answer to rising costs and diminishing supply of highly skilled machine operators. Electronic controls are housed in the cabinet at right. The tracer system utilizes a cathode-ray light and phototube to read the drawing, translating the signals into impulses that control the servo system.

(below) PRELUDE TO automatic assembly often is 100 percent inspection, prohibitive in cost and time as a manual operation. This hopper feeder and air gage are teamed at Superior Steel Corp., Carnegie, Pa., to do the job automatically. Both wall and base thickness of jacket cups for copper-clad bullet are checked by the air jets in the Moore Products Co. installation. Pneumatic relays receive amplified measurement signals, actuate sorting gates. Cabinet dials show actual piece part dimensions.



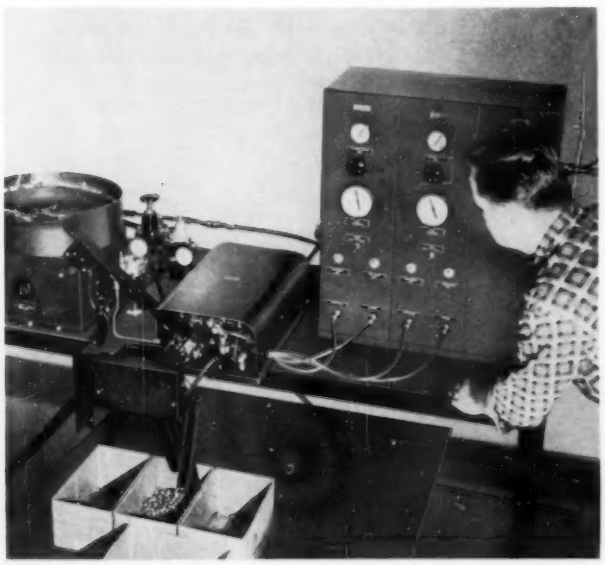


Fig. 1. Offices and the employees' service wing, which houses the cafeteria, are attached to the new manufacturing building. The production space is enclosed by insulated, aluminum panels on base walls of brick.

MODERN PLANT *designed for expansion*

By T. M. Garry
Vice President
Schick Incorporated
Lancaster, Pa.

What does a company do when its production facilities have grown like Topsy? What kind of help can such a company get? This article describes what a boon it can be to have to start all over again.

MANUFACTURE OF electric shavers is no different from the manufacture of any other precision product. Parts have to be purchased, made and assembled to give the best product with the least expense. Adequate production facilities are a necessary prerequisite to minimizing production costs. In just 10 months after the decision to make a change was made, Schick moved from a cramped, inefficient multistory plant in Stamford, Conn. to a modern single-story building, *Fig.* 1, in Lancaster. This new plant was designed with future expansion in mind.

A move such as this took planning and help. Almost two years were spent in determining that a drastic change in production facilities was neces-

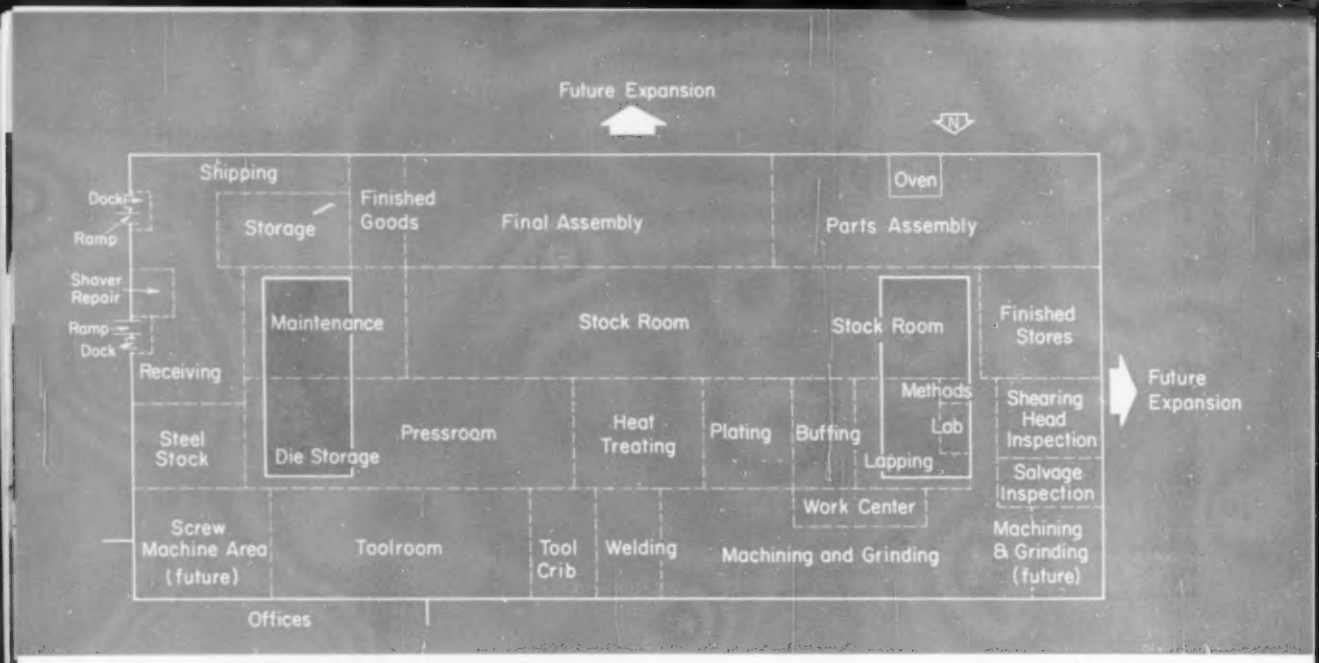


Fig. 2. (above) Layout of the manufacturing building is planned to facilitate materials handling and smooth flow of in-process work. The two shaded areas mark the overhead locations of the service mezzanines.

Fig. 3. (left) One of the two mezzanines that house all manufacturing service equipment and personnel facilities. Directly under this mezzanine are the die storage area and pressroom. The coils of electrical steel strip move directly from this receiving bay to the pressroom. At the right is part of the toolroom.

sary. Actual operating costs had to be compared with estimated costs, sources of materials and services had to be studied, problems of moving key personnel and recruiting a labor force had to be anticipated and the geographical market for shavers had to be considered in terms of transportation. When it became obvious that the Stamford plant could no longer be used because of physical limitations, The Austin Co. of Cleveland was commissioned to locate a good site, design and erect a building, and move and install the machinery.

Many possible plant sites were considered and three were investigated in considerable detail. The site chosen is 56 acres of former farm land adjacent to arterial highways and a main-line railroad, and surrounded by land that is still being farmed. This site meets the current and future needs of a light-industry plant, including availability of a dependable work force.

Before design of the new plant was started, various production problems caused by the physical plant structure at Stamford were reviewed. General specifications for the new building included provisions for: production flexibility within an allotted space, future expansion, more-than-adequate storage, straight-line production, good materials handling, single-level operations and ample service facilities. These ideas fit in well with Austin building techniques that have been developed over a long time, and detail designs and specifications were quickly prepared. The result is an area sheltered from the elements within which production operations can be economically carried on and changed to meet new processing methods.

Fig. 4. The toolroom shows how flexible machine placement can be. Electricity is supplied to each machine through a spring-mounted cable coming from the overhead bus duct. Where required, dust collection is achieved through individual, vertical stacks. Floor drains are not needed because individual machine sumps are serviced by a pumping cart.

The manufacturing area is slightly more than 100,000 square feet and has a minimum of columns. Actual column spacing is 60 feet north-and-south and 20 feet east-and-west. With few columns, machines can be located to result in good production. There is sufficient space around each machine so that setup and maintenance operations are unhindered. With few exceptions, machines are not bolted to the floor but rest on felt pads. They can be relocated with little effort so that production layouts need not be frozen.

This plant had an immediate potential for a 60 percent increase in production and an immediate decrease in handling costs of 30 percent was realized. Within the present building walls, there is space for an additional increase in production of both complete shavers and replacement shaver heads. The south and west walls have been designed so the manufacturing area can easily be expanded in these directions.

To a large extent, reduction of handling costs results from single-level operations, straight-line flow, *Fig.* 2, and wide aisles. Four 8-foot aisles run east-to-west, and 6 and 8-foot feeder aisles run north-to-south. In-plant traffic is now on wheels, fork trucks and roller conveyors. This was impossible under the multilevel, crowded conditions at Stamford. With adequate space, it has been possible to palletize outgoing shipments, reducing handling costs sharply.

All boilers, air compressors, main electrical switchgear, washrooms and lockers are located on two 40 by 90-foot masonry-enclosed mezzanines, *Fig.* 3. Mezzanines have identical equipment and serve half the building. Lengths of all utility lines are thus minimized. These mezzanines are isolated from the structural steel framing of the building proper. They are supported by separate steel columns which lead to a clean design.

Another physically isolated area in this building is the pressroom. Stamping presses, rated up to 30 tons, could cause undesirable vibrations throughout a plant of this type. The pressroom floor is therefore completely isolated from the rest of the structure. Vibrations do not cross the barrier between the pressroom and plant floors. Scrap from

the stamping presses is put in portable bins and removed by fork trucks.

Lighting and basic construction of the building add up to a good production environment. Overall clearance in the plant is 18 feet, and continuous and semicontinuous rows of fluorescent lights provide good illumination. At bench height, light levels are: assembly areas, 55 foot-candles; machining areas, 45; offices, 50; and storage areas, 10.

Because of the available overhead space, machinery layout is even more flexible. All services are overhead. Floor trenches are not used. Centrally located bus ducts carry power from the mezzanines to the work areas. Machines are connected to the bus ducts by individual spring-mounted cables. Machines can thus be moved without regard to power source or the limitations imposed by rigid conduit. The dust collection system also runs overhead. Individual machines are connected to this collection system by vertical stacks, *Fig.* 4. To complete the picture of machine placement flexibility, sump pumping equipment services machines using coolants; fixed floor drains are not used.

For the comfort of the employees and to give optimum production conditions, the original manufacturing building design included four convertible ventilating-filtering units and a completely air-conditioned office. The ventilating units are mounted on platforms under the roof and include steam coils to provide heat during the winter. Since these units were of convertible design, it was possible to air condition the entire plant by installing cooling coils in the units and refrigeration equipment on one of the mezzanines.

One area of the plant had special ventilating provisions from the beginning. This area includes the heat treating and electroplating, *Fig.* 5, departments which generate considerable heat. These departments are surrounded by partial curtain walls of corrugated asbestos that extend from the roof to within 8 feet of the floor. These curtains trap heated air and vapors and allow them to be expelled directly outside through a 23,000-cfm exhaust fan. The curtain walls surrounding these departments, the baking oven in parts assembly and other strategic locations also would be an aid in controlling fire.

Although there were 5000 square feet of marginal space to work with when operations moved to Lancaster, management is already considering expanding the manufacturing building. More production could be squeezed into the present area, but the reduced costs and improved production efficiency resulting from freedom of movement have convinced management that they should never again force production to operate under conditions similar to those at Stamford. Because the need for expansion was anticipated, the company will be able to retain production flexibility.

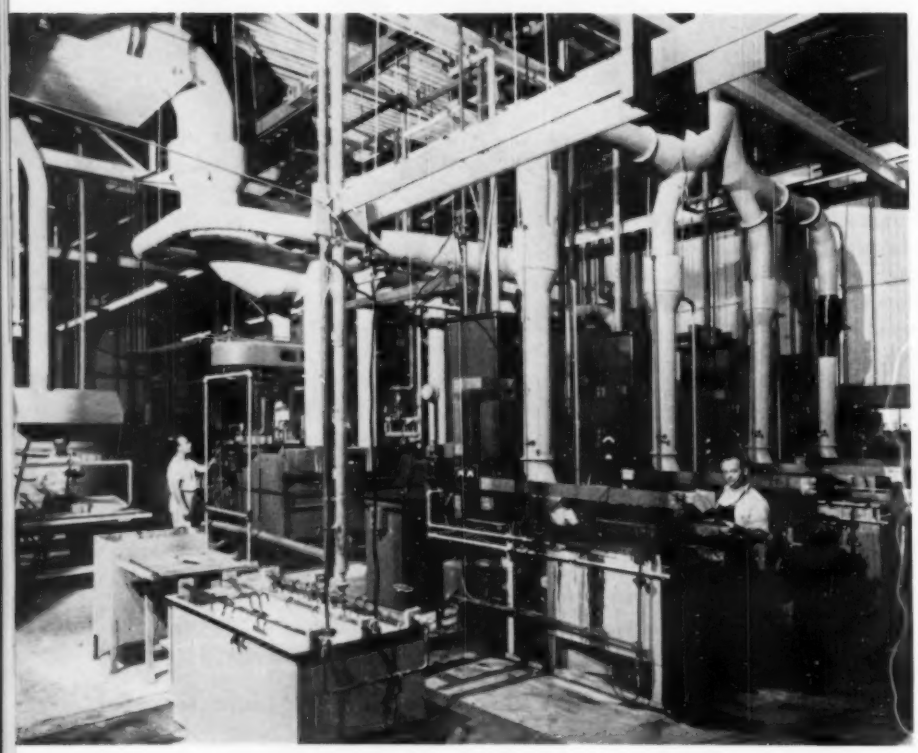


Fig. 5. Heavy electroplating equipment was transported from Stanford to Lancaster and installed by the building contractor. Partial curtain walls surrounding this area, right background, prevent the heat generated by this equipment from going into adjacent production areas.

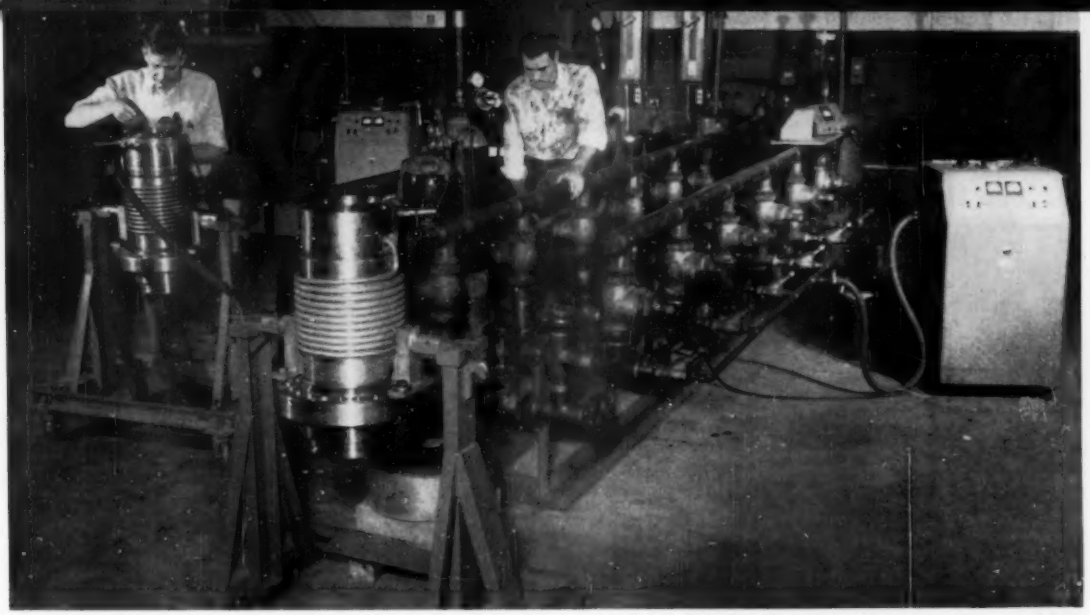


Fig. 1. Manifold setup testing canned motors for zero leakage. Mass spectrometer is at right.

testing for ZERO leakage in canned motors

By R. E. Lawther

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Atomic Equipment Dept.
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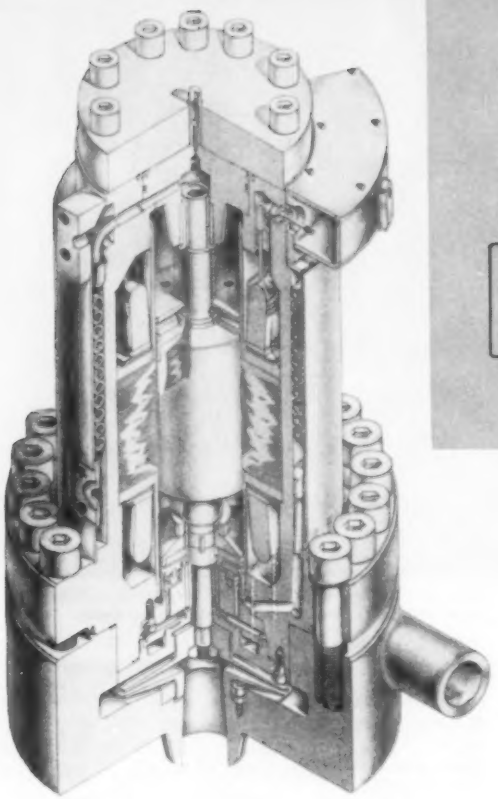
With the advent of atomic power systems, the need for high-temperature, high-pressure hydraulic machinery having zero leakage during normal and abnormal operating cycles was apparent. Hence, practical methods of inspecting and testing production components for zero leakage became necessary.

This testing can be accomplished in three ways: (1) by exhausting all air from the component, applying helium to the exterior of the container and measuring the leakage with a mass spectrometer attached to the vacuum line, *Fig.* 1; (2) by filling the component with liquid under high pressure and detecting leakage by a drop in gage pressure; or (3) by filling component with helium under high pressure and detecting leakage through the use of a helium probe connected to a mass spectrometer.

One point to remember is that, for safety reasons, hydrostatic pressure testing must be performed before pneumatic testing. Due to the expansion of gases, pneumatic testing should always be considered a hazardous test. For satisfactory testing, hydrostatic and pneumatic equipment must be capable of pressure testing objects having volumes ranging from 1 cubic inch to 50 cubic feet.

Pressurized hydraulic systems are usually designed, erected and operated in accordance with requirements of the U. S. Navy Bureau of Ships, local state authority or ASME code. These regulations normally require testing under prescribed hydrostatic test pressures that are dependent upon the maximum allowable working pressure for the system or component.

Normally, hydrostatic testing is sufficient evidence that a system or component part is leaktight and satisfactory for safe operation. When dealing with radioactive systems, however, an added assurance of tightness is considered necessary. This is obtained by subjecting critical components and sys-



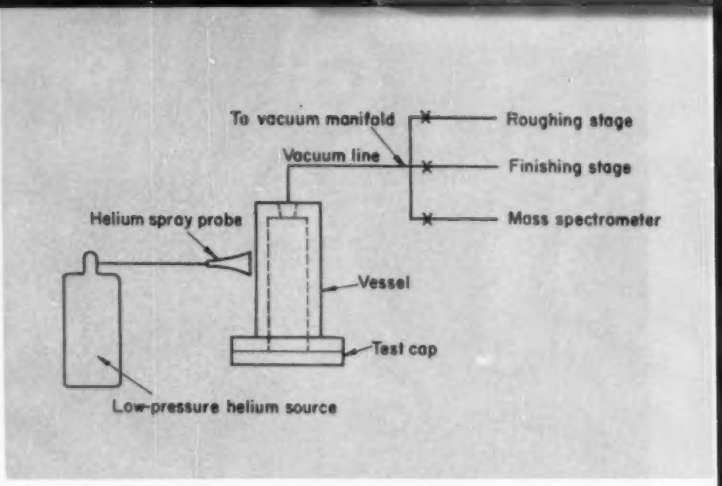


Fig. 2. (left) Cutaway of canned-motor pump shows design of typical high-pressure components.

Fig. 3. (above) High-vacuum, low-pressure helium test setup. A plastic bag filled with helium and placed around vessel may be used in lieu of the probe method.

tems to high-vacuum or high-pressure tests using helium gas and a sensitive detecting device.

Present operations require zero leakage testing of canned-motor pumps and valves. A canned-motor pump, *Fig.* 2, consists of an integral squirrel-cage induction motor operating inside a primary and secondary pressure vessel. The primary pressure vessel is heavy-walled, designed and constructed to assure safe operation. The secondary vessel is thin-walled, designed to isolate and protect the induction motor components from the pumped medium. It is from this design feature that the term "canned motor" originated.

The rotor winding of the squirrel-cage induction motor is made of die-cast aluminum or brazed copper and is enclosed within still another thin-walled vessel or can. The hydraulic end of the canned-motor pump consists of a pump casing and impeller. The pump casing houses the impeller and has connections for the hydraulic system suction and discharge lines. Since it is subject to full system temperature and pressure, the pump casing is classified as part of the power piping system.

The canned-motor pump also employs a thermal barrier which walls off the hydraulic section of the pump from the motor. Its function is to prevent free interchange of hot-system liquid in the pump section with coolant in the motor section. It is designed so that an internal air space is provided to reduce heat transfer across it to a minimum.

Test Equipment

Zero-leakage testing on a production basis requires numerous pieces of equipment such as a piping manifold, vacuum pumps, diffusion pumps, helium leak detector, gages and fixtures, *Fig.* 1. The vacuum pumps are permanently connected to the piping manifolds and the system is made leaktight by soldering all connections. Manifolds are usually set up in two stages, roughing and finishing. The roughing stage uses one vacuum pump; the finishing stage uses an oil-diffusion type pump in combination with an additional vaccum backup pump. Valves separate the two manifold stages.

The pumps are controlled automatically by solenoid and water-pressure switches. Also, the manifold has liquid nitrogen refrigeration traps (cold traps) to collect water, oil and other vapors, thus eliminating the possibility of condensable vapors entering the ionization gages.

A portable mass spectrometer leak detector for detecting helium gas is essential to the zero-leak testing operation. This instrument can detect 1 part of helium gas present in 200,000 parts of air. Helium leakage is detected and measured by connecting the mass spectrometer detection line into the vacuum manifold after a vacuum has been established. The evacuated apparatus under test is sprayed with a jet of helium or enclosed in a helium-filled plastic bag.

Mass spectrometers can also be used to detect helium leakage when apparatus under test is pressurized with helium gas. In this method the mass spectrometer detection-line probe is slowly moved around the surface areas to be tested. The sensitivity of the instrument in this instance is dependent upon

the rate of probing, amount of pressure and amount of helium used.

In most cases, fixtures for vacuum and high-pressure testing are of the bolted or clamped type using neoprene O-ring gaskets for vacuum and pressure seals. Fixtures are copper plated to reduce corrosion. Where large volumes are to be pressurized, fixtures are designed to reduce the effective volume, minimizing hazards associated with large pressurized vessels.

Special greases and sealing compounds, which will neither contaminate vacuum pump oils nor readily dissolve in water under high pressures, are used to seal and lubricate pipe fittings and fixture joints. Various sizes of rubber stoppers are used to close ports and openings. High-pressure tubing, piping, fittings and valves are required for pressure testing. Rubber vacuum hose is used for vacuum testing, together with pressure and vacuum gages.

Maintenance of the systems and supporting equipment is of prime importance but not complicated. All cold traps must be cleaned daily with acetone and water; otherwise, trapped particles are carried through the system. This contaminates vacuum pumps and their oil systems, causing an increase in the time required to empty the system. Vapors and dirt in the mass spectrometer cause false and erratic indications. A typical manifold system has provision for running six individual test procedures simultaneously, each testing outlet being isolated from the others by valving.

Al high-pressure testing, pneumatic or hydrostatic, is conducted in a pit measuring 18 feet long by 8 feet wide by 8 feet deep. Apparatus under test is observed from floor level. Malfunctioning is disclosed by changes in gage pressures, or visual examination of dye penetrant coatings or soap-bubbles.

High-Vacuum, Low-Helium Testing

The high-vacuum, low-helium test is ideal for those applications where it is not feasible to subject components to water or other hydrostatic mediums. Also, this method of testing, *Fig.* 4, possesses the greatest element of safety. At the same time, it is extremely sensitive when used in conjunction with a mass spectrometer leak detector.

Typical test sequence is:

1. Lubricate and assemble test fixtures on apparatus to be tested.
2. Prepare manifold and mass spectrometer leak detector.
3. Connect test lines between apparatus and manifold.
4. Open roughing manifold valve and allow roughing system to evacuate apparatus to 5 to 20 microns vacuum.
5. Close roughing valve and open finishing valve.

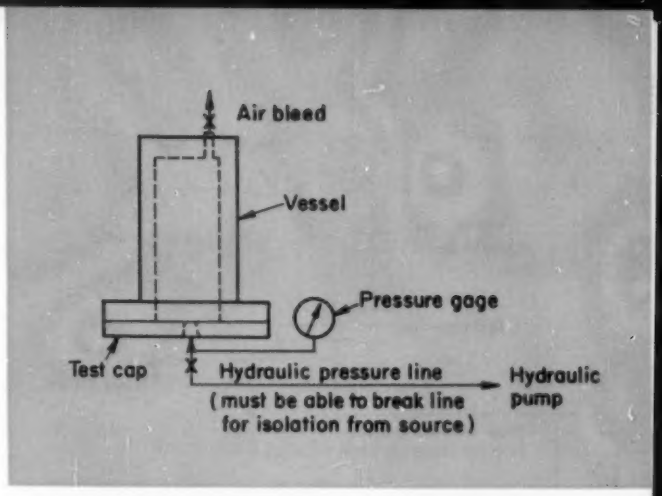


Fig. 4. Hydrostatic test setup.

6. After a vacuum of 0.10 micron has been attained, connect mass spectrometer leak detector into the system and isolate apparatus from finishing manifold. Mass spectrometer will maintain vacuum.
7. Spray a fine jet of helium gas over surface areas of apparatus under test and observe mass spectrometer leak-rate meter for evidence of helium pickup within the manifold system, (plastic bag around apparatus under test filled with helium gas can be used in lieu of helium spray.) Increase in the leak rate meter indicates leakage.
8. Pinpoint the leak by use of the spray technique and mark area for repair.
9. After testing is completed, close off the mass spectrometer.
10. Release the vacuum slowly in the apparatus under test and dismantle the test assembly.

Hydrostatic Tests

Hydrostatic testing should be conducted prior to a high-pressure pneumatic test as the hazard element is greatly reduced. Hydrostatic pressures up to 10,000 psi can be readily obtained by using a hand-operated hydraulic pump. Pressures in excess of 10,000 psi are best obtained by employing power-driven equipment. Whenever possible, the hydrostatic pressure inlet should be located at the bottom of the vessel and the air bleed outlet at the top, *Fig.* 5.

Test procedure:

1. Lubricate and assemble test fixtures and gages on apparatus to be tested.
2. Place vessel and equipment in pit.
3. Completely fill vessel with water or other desired liquid. Make certain all air has been excluded since small air cavities can be dangerous and, in addition, can cause erroneous gage readings. Air usually can be eliminated by overflowing water freely from the apparatus while it is repositioned or jogged to break up air entrapments.
4. Dry surfaces of apparatus under test.

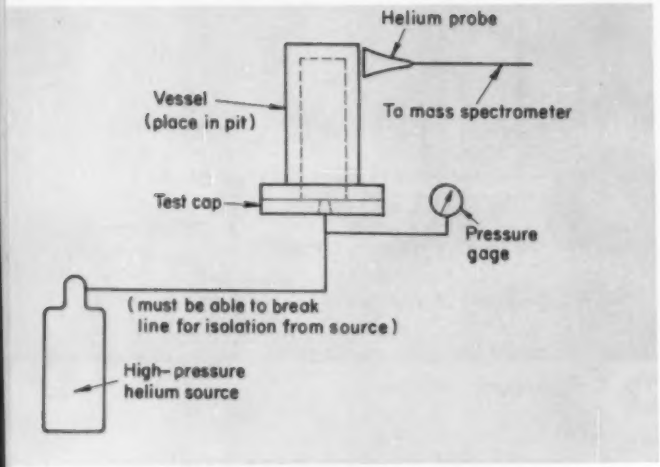


Fig. 5. High-pressure helium test setup. Again, a plastic bag may be used around vessel with probe inserted at uppermost point of bag to detect helium.

5. Start pressurizing pump and increase pressure to approximately one-half the desired test pressure. Examine vessel for leakage. If no leakage is present, increase the pressure to the desired test pressure.
6. Disconnect apparatus under test from pressure source.
7. Hold test pressure for described length of time and examine vessel closely for weeping, leakage or drop in gage pressure. The vessel can be coated with a lime or chalk wash to facilitate visual inspection for leakage.
8. Mark leak areas for repair.
9. Slowly release pressure from the apparatus and dismantle the test assembly.
10. Clean and dry the apparatus and test fixtures.

High-Helium Tests

Usually this test should not be made before a hydrostatic test has been conducted on component since pneumatic testing should always be considered a hazardous test. Also, this test should only be used in those cases where absolute zero leakage is a must, such as in nuclear components, or when it is not possible to conduct a hydrostatic pressure test, such as when electrical components are present within the tested pressure vessel. Helium pressures up to approximately 2400 psi for volumes up to 230 cubic feet, can normally be obtained from commercial helium-gas cylinders. Helium pressures up to 2500 psi, for volumes up to 37,000 cubic feet, can be obtained from standard Navy helium trailers. Pneumatic testing, *Fig.* 6, should always be done in a pit with sandbags used to afford supplemental protection.

Test procedure:

1. Lubricate and assemble test fixtures on apparatus.
2. Prepare mass spectrometer leak detector and helium gas supply.
3. If feasible, enclose apparatus being tested in a plastic bag.
4. Lower apparatus into pit and apply sandbags as required.
5. Introduce helium gas and increase pressure to approximately one half the desired test pressure. Slowly probe the surface or place probe inside plastic bag and observe mass spectrometer leak-rate meter for evidence of helium pickup.
6. If there is no evidence of leakage, slowly increase the test pressure to the desired value.
7. Disconnect the apparatus under test from the pressure source.
8. Hold test pressure for the desired length of time and examine vessel closely by probing or with the probe in the plastic bag, observing the mass spectrometer leak-rate meter for evidence of helium pickup. If there is evidence of leakage, pinpoint the area by using the probing technique and mark area for repair.
9. After testing is completed, close off the mass spectrometer.
10. Slowly release pressure from the apparatus and dismantle the test assembly.

By following these procedures, zero-leakage testing can be set up for production for testing high-pressure hydraulic components required in the machines of today and for the nuclear-powered systems of tomorrow.

INDEX *of 1956 technical articles appears in this issue*

Busy engineers are seldom able to clip all articles and informational material of interest to them when it appears in the pages of THE TOOL ENGINEER. To aid them in finding all pertinent coverage of a given subject, when they need to refer to it, a complete index is included in the December issue each year. It starts on page 271 of this issue.

In effect a private librarian, the Annual Index contains a separate listing of major articles by authors as well as a listing by subjects. Numerous cross references and inclusion of many sub-topics are provided as a further help in locating all material on a specific subject published in the current year.

applications of automatic assembly

By **Ralph H. Eshelman**
Associate Editor
and
T. W. Black
Assistant Editor

While automatic assembly is relatively new to industry, many significant applications have already been developed. By keeping abreast of current trends, tool engineers can be in a position to evaluate the possibilities of automatic assembly in their own plants.

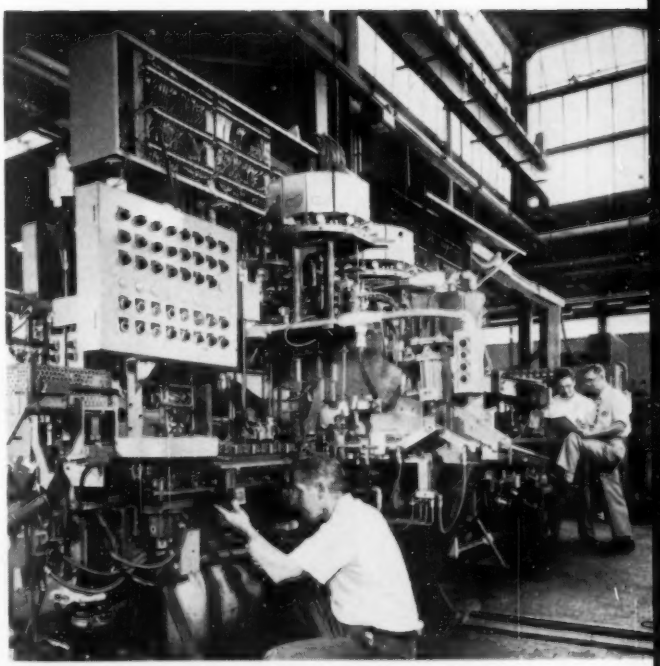


Fig. 1. Automatic assembly for fan and water pump bearings at the Sandusky, O. plant of New Departure Div., General Motors Corp. In this installation all components, consisting of outer ring, inner shaft, steel balls, retainer and closures are assembled, and automatic inspection of all dimensional and functional specifications accomplished.

AUTOMATIC ASSEMBLY methods are still in their infancy and cannot be applied by following established procedures. Nevertheless, where product volumes are high, savings over hand assembly methods often justify development and construction costs. An increasing number of manufacturers in the metalworking and electronics industries are turning to automatic assembly as one means of reducing manufacturing costs. The competitive pressure for greater productivity, coupled with possible future manpower shortages, gives increased

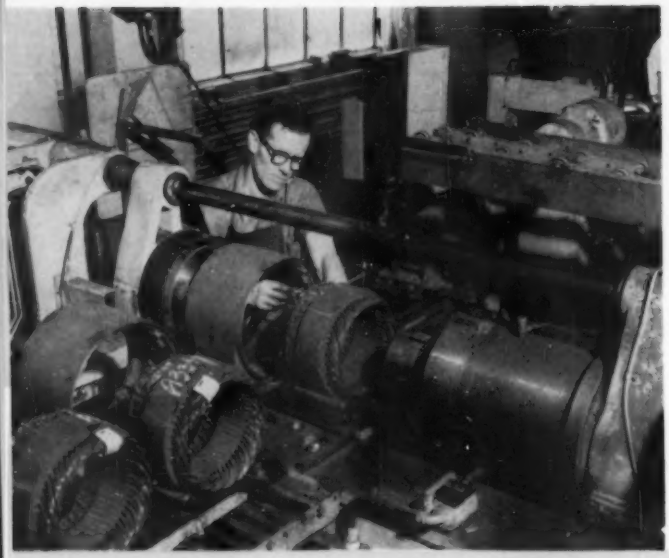


Fig. 2. Stator and stator frame assembly machine used at General Electric Medium Induction Motor Department.

significance to current developments in this field.

Nearly all automatic assembly devices and machines, *Fig.* 1, are "special" since their design is necessarily determined by the specific parts and operations involved. Fully automatic assembly machines incorporate mechanisms to load and assemble all component parts and unload completed assemblies. Some machines perform only one operation; others utilize rotating tables or shuttles to carry parts between assembly heads which perform a series of successive operations. Depending on relative cost factors, all of these operations may be fully automatic or some may be semi-automatic.

Single Operation Machines: Automatic assembly devices need not be complicated. Often, the installation of mechanical materials-handling equipment in conjunction with an existing machine can make assembly operations automatic. One example is the assembly of electric motor stators and stator frames at the GE Medium Induction Motor Dept., Schenectady, N. Y. These components are assembled in a horizontal press, *Fig.* 2.

The wound stator and frame are carried to the

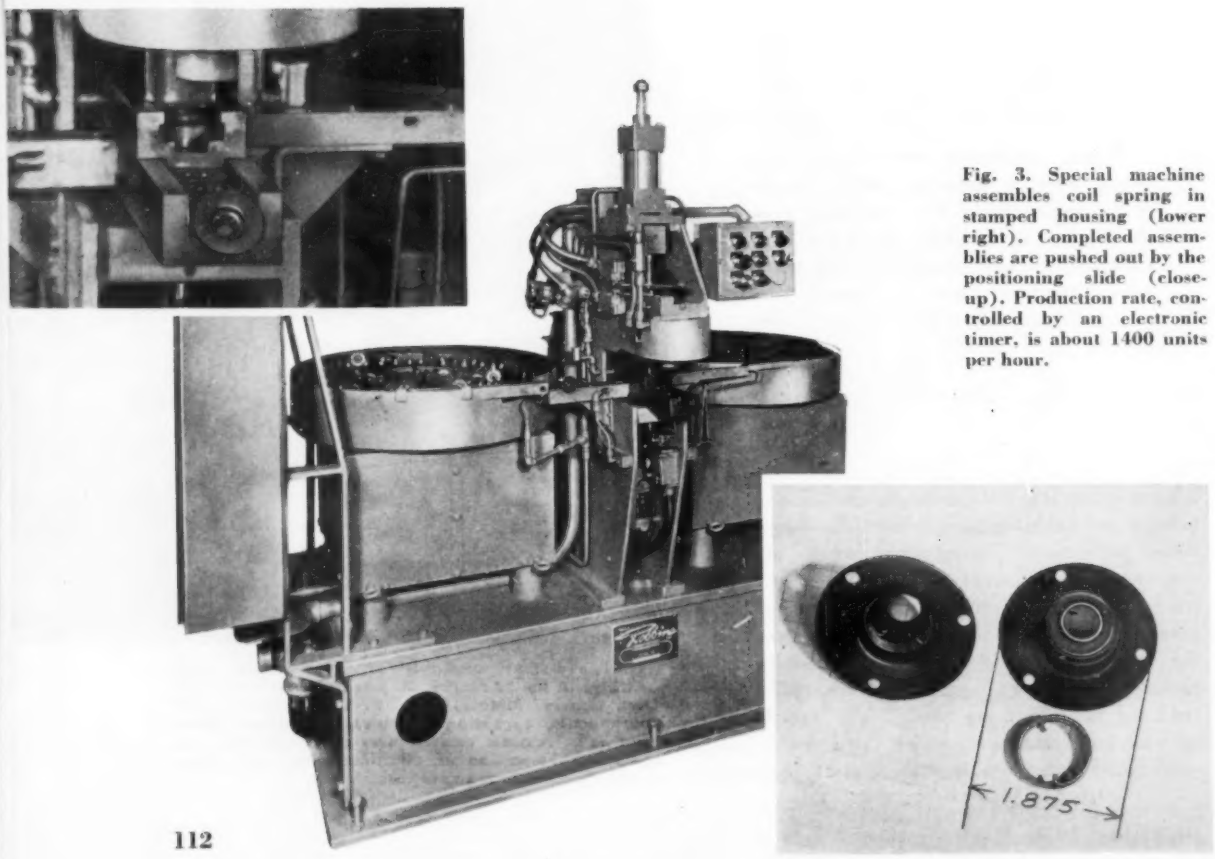


Fig. 3. Special machine assembles coil spring in stamped housing (lower right). Completed assemblies are pushed out by the positioning slide (close-up). Production rate, controlled by an electronic timer, is about 1400 units per hour.

press on roller conveyors. Two air-operated pins, which fit into reamed holes in the feet of the frame, locate it in the press. Three air-operated chuck jaws expand in the stator bore, locating the stator, which is then carried forward on a hydraulic ram and pressed into the frame. A spacing fixture mounted on the press correctly locates the stator in the frame. A reversing switch causes the ram to retract and activates a shuttle which takes the stator out of the press and deposits a new frame in position for assembly.

An interesting feature of this assembly operation is that it is integrated with subsequent machining operations. The same shuttle which removes stators from the press carries them to a special drilling machine, locating them in the drilling fixture.

An unusual machine has been developed by Omer E. Robbins Co. to install and position a coil spring in a cup-shaped housing, *Fig.* 3. The two parts comprising this subassembly are fed by standard vibratory hoppers from opposite sides of the machine. First, the housing is dropped open side up into a track of hat-shape cross section. A spring is fed over it. Four fingers, in the form of two sliding V-members, compress and hold the spring while a vertical ram presses it into the cup. The assembly is then shuttled under a second ram with a locating device, close-up *Fig.* 3. This ram has a nonrotating central locator which prevents rotation of the spring. Fingers in an outer rotatable ring pick up the holes in the cup flange and rotate the cup into proper relation to the spring end.

Some automatic assembly machines incorporate inspection and testing equipment, making them "automatic factories" on a small scale. One such machine, developed by Cargill Detroit Corp., assembles rear clutch drums with mating serrated steel sleeves. The cast-iron drum, heated to 900 F, is discharged from a self-emptying furnace. A conveyor above the machine, synchronized with the furnace, delivers the mating sleeve at the same time. Positioning guides aid in orienting the parts, which are located by stop pins. A horizontal ram positions the heated drum and sleeve under the ram head of the machine for assembly. On completion of the pressing operation, the drums are carried on a track into a quench tank.

Simultaneously, a previously quenched assembly in the tank is conveyed from the tank to a ram test section. In the ram test, a 100-lb load is applied

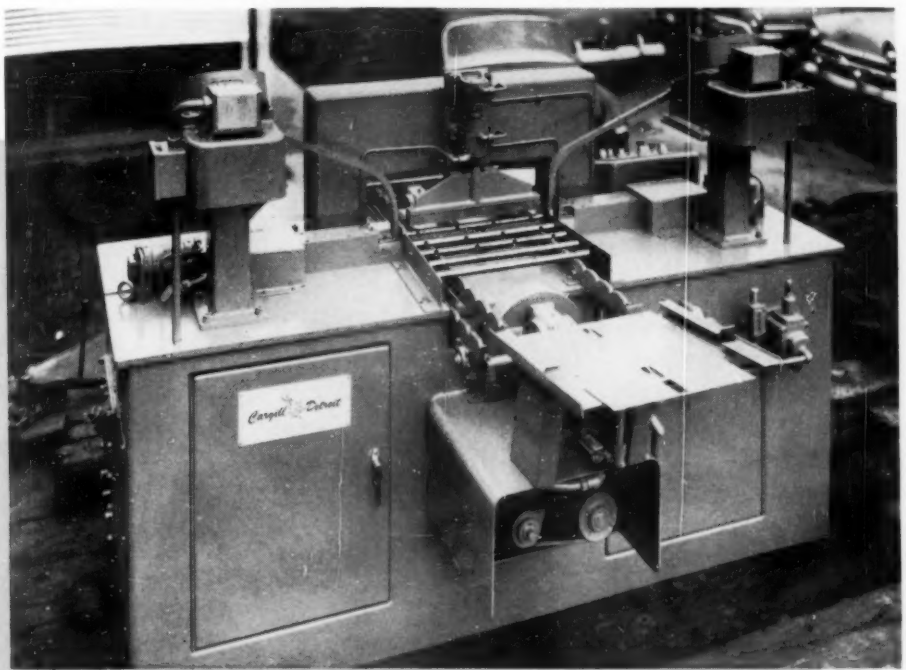


Fig. 4. Special machine presses end plugs into rocker arm shafts.

to the assembly to determine if there is any tendency for the drum and sleeve to separate. Satisfactory and unsatisfactory assemblies are automatically segregated and emerge from the testing station at different points.

End plugs are assembled to rocker arm shafts in another integrated assembly machine developed by Cargill. Shafts are conveyed from a washer into and through the machine, *Fig.* 4. Two small vibrating hoppers continuously feed end plugs into an orienting track. When a shaft is in position for assembly, it is held in place by a vertical ram. At the same time, horizontal rams are activated, pressing the plugs into the open ends of the shaft. The unit is capable of producing 600 assemblies per hour.

Integrated Machining and Assembly: Automatic assembly operations can sometimes be combined with machines performing other operations. One successful development along these lines is a Snyder six-station trunnion type index machine which processes 375 bronze castings per hour. One end of the casting is drilled through, reamed, hollow-milled and threaded. The other end is hollow-milled, faced, drilled and tapped. Pressed metal deflectors, fed from an inclined chute magazine, are assembled on the castings and spun into place at the last station. The operator keeps the magazine full of stampings and also manually loads and unloads parts from the machine. Sufficient flexibility is provided in the feed mechanism so that three sizes and shapes of deflectors can be assembled.

Rotary Machines: Where a number of assembly operations on small parts are performed successively, rotary index machines are often used, *Fig.* 5. The basic assembly machine illustrated, developed by Multra Corp., has been tooled for the production of mercury batteries. Ten of the 16 available stations are utilized for battery assembly. Each station is individually tooled and fed.

In station one a metal can is fed and oriented by a vibrating feeder and transported to the work station on a belt conveyor. The can is inserted into the work station nest by means of an air cylinder and escapement mechanism. A paper sleeve, also fed and oriented by a vibrating conveyor, is transported to an air-operated conveyor by a belt conveyor at station two. The plunger brings the paper sleeve into form, centers it with the metal can, and inserts it in the can. A second metal can is added to the assembly in station three. These parts are transferred from a feed wheel, which is

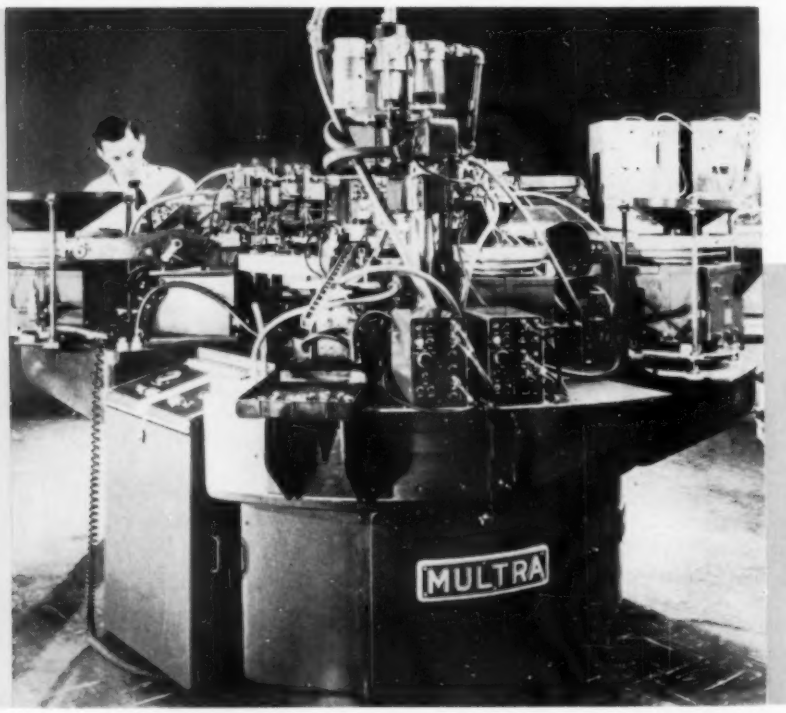


Fig. 5. Operations performed by battery assembly machine include metering a liquid into the batteries.

indexed with the machine, into the assembly by an air-operated plunger. In station four, a paper cylinder, fed and oriented by a vibrating hopper, is transported through a vibrating gravity chute into a feed wheel, and is then transferred from the feed wheel into the assembly by a plunger as done at preceding stations. A rubber disk is inserted at station five in similar fashion.

At station six, the assembly is transferred onto a chain conveyor synchronized with the rotary machine. As the assembly travels along this conveyor, a liquid is dispensed into the battery. A plastic ring, fed from a vibratory feeder, is transported on a belt conveyor to an air-operated plunger, station seven. The plunger transfers the ring into the assembly and then inserts the entire unit back into the work station nest on the machine table. A vibrating feeder is used in conjunction with a plunger to insert metal caps in the assembly at station eight. Air-operated crimping and ejection operations take place in stations nine and ten.

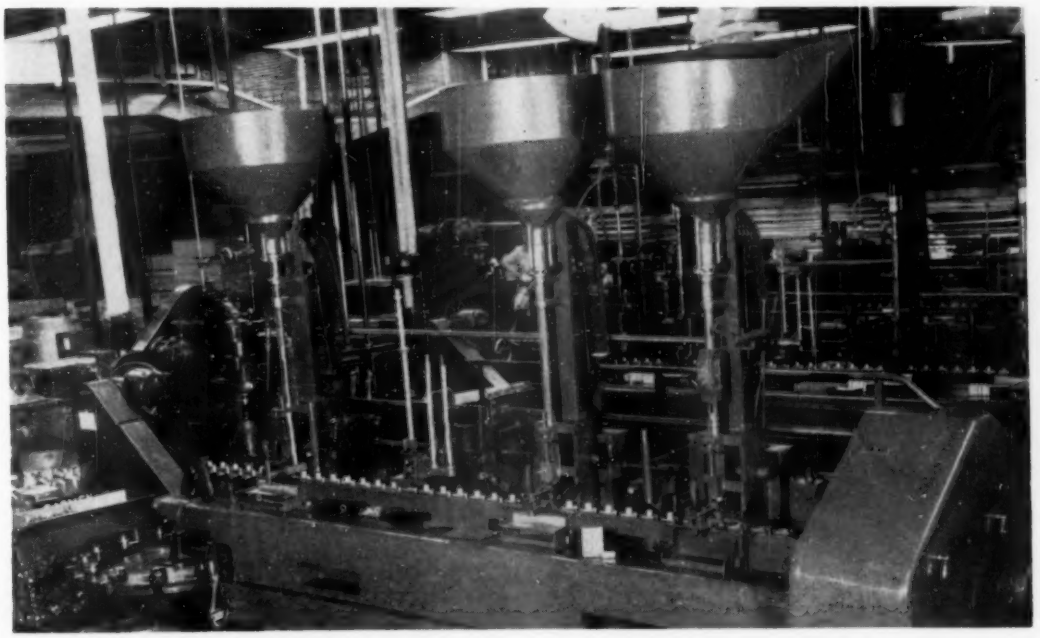
An interesting feature of the machine is the provision of a feedback system. If a part is not inserted at one of the stations, the defective assembly is rejected at a later station and the machine stops. The basic machine can be converted to assemble different parts by removing the existing feeding and inserting heads, and substituting other heads of appropriate design.

Oval Track Machines: Rotary-table type assembly machines are compact and indexing can be precisely controlled. They have proved quite satisfactory for operations such as the one described. Transfer type machines, in which parts are carried from station to station by shuttles or conveyors are also being successfully used for automatic assembly operations.

At Delco-Remy Div., General Motors Corp., such machines have been in use for more than 20 years in the assembly of cranking motors, generators, relays, switches, solenoids, condensers and controls of various kinds. More than 1000 special assembly machines have been built by Delco-Remy during this period. Commutators, ignition coil windings and other parts of rather stable design have warranted development of most of the automatic equipment. However, a number of products subject to design changes have been economically produced on special assembly machines by designing equipment which can handle anticipated product changes with little or no modification, *Fig.* 6.

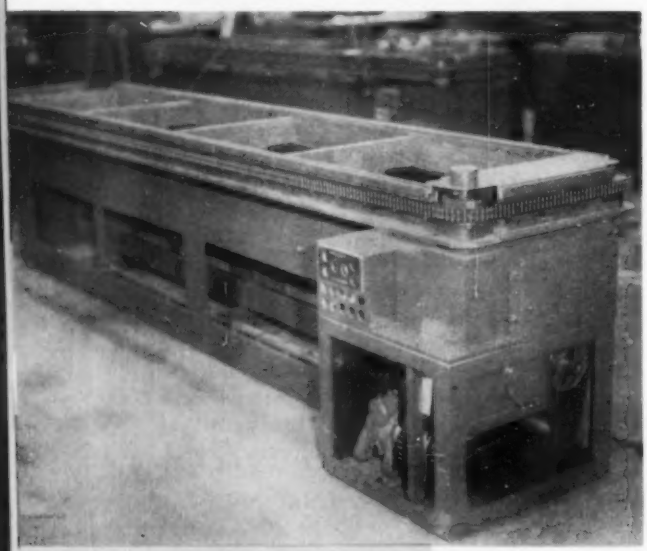
Delco-Remy engineers have found that automatic assembly machines with a wide oval track, *Fig.* 7, permitting linear flow from one operation to the next as assemblies are built up. have particular merit. There is sufficient room to perform some operations manually if necessary. Ideally, two or more such machines can be placed front-to-end,

Fig. 6. Over-and-under type in-line machine used to assemble ignition condensers at Delco-Remy Div., General Motors.



allowing a long series of operations to be performed automatically. Such machines have been developed to the extent that they can be classed as semistandard at Delco-Remy.

The condenser assembly machine is typical of the many applications of automatic assembly machines at the ten Delco-Remy plants at Anderson, Ind. An automatically controlled chain track indexes from station to station. Nests attached to the chain at appropriate positions accept parts from either stacks or hoppers. As each part is added, an automatic device determines whether the part is in correct position to receive the component to be assembled next. If not, the mechanism stops and a light flashes, indicating to the operator that his attention is required.



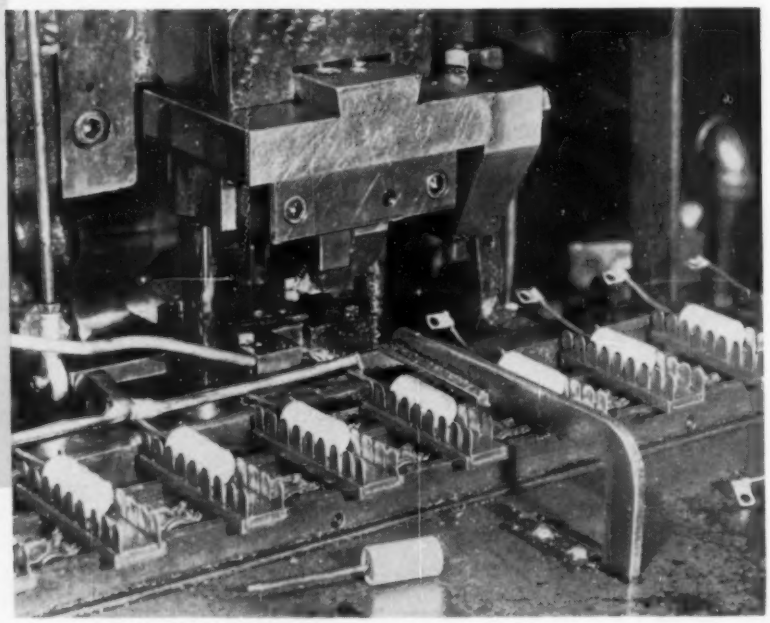
Next, the finished assemblies are inverted and leads, fed by hand, are joined to the condensers in a crimping dial. The work then moves on an inclined conveyor to a second in-line machine which electronically inspects the condenser, rejects and sorts faulty condensers, makes and assembles the connection clip, *Fig.* 8, and welds it to the lead. These machines, according to Delco-Remy engineers, have justified development costs by reducing the assembly cost of the condenser, while improving quality. They have proved, also, that this type of oval track machine fits well into production plant layouts.

Nonassembly operations are incorporated on the machines where appropriate. A typical combination of operations is that involving the circuit-breaker lever for distributors. The operations performed include sorting and hopper feeding parts, staking, reaming, milling, hot upsetting, burring and inspecting.

An oval track machine similar to those developed at Delco-Remy is utilized to assemble tie rod sockets at the Chevrolet-Buffalo Div. of General Motors Corp. The machine was engineered and built by the GM Process Development Staff in cooperation

Fig. 7. (above) Base and transfer mechanism of a Delco-Remy wide track assembly machine. The chain track is automatically controlled to traverse five inches during an index time of 0.9 second.

Fig. 8. (right) Setup for making a connector and assembling it to a lead in a Delco-Remy transfer machine.



with Chevrolet development engineers.

The tie rod socket assembly, *Fig.* 9, consists of a tie rod socket, ball stud, ball stud seat, spring seat, spring, dust cover and rubber seal. Prior to development of the special machine, individually operated air fixtures and spinners were used, with manual loading and unloading. Four lines of fixtures with four operators and one material handler for each line, were required. Two automatic machines provide an average of 2000 sockets per hour with half the direct labor required for the old system. Also a serious safety hazard has been eliminated, since the individually operated air fixtures had caused a number of hand injuries.

Eleven operations are performed in the automatic machine, *Fig.* 10. At station one, parts are manually loaded. Ball stud seats are hopper fed and pressed into position in station two, and ball studs are hopper fed in station three. A metered supply of grease is applied in station four. Spring seats are added by hopper feeding in station five. Springs are manually fed at station six. Station seven is a checking point, where assemblies are automatically inspected for missing parts. Dust covers are hopper fed and pressed into position in station eight. At station nine, metal is spun over the cover. Assemblies are manually turned at station ten and a rubber seal is added. Unloading is performed automatically at station eleven by means of a simple deflector.

Straight-line Machines: A high degree of automaticity has been applied to automative cylinder head machining operations and during the past few years there have been several successful developments of cylinder head assembly machines intended to improve the over-all productivity of cylinder head manufacturing operations. One such machine, developed by Snyder Tool & Engineering Co., applies sealer material and assembles three welch plugs in cylinder heads, air tests the finished assemblies, and automatically rejects from the machine any heads which do not meet test standards. The machine, *Fig.* 11, is of the in-line transfer type, with seven stations, and is loaded from a conveyor.

Welch plugs are fed to the machine from individual hoppers that deposit one plug at a time in front of hydraulically powered plungers that press them into the heads. Maximum-stroke switches on each plunger govern the machine cycle in such a manner that parts will not be transferred if any plug is not pressed in to depth.

Heads are transferred from station to station by a hydraulically powered walking beam type nest. In the second station, hydraulically operated fingers move one head to one side of the machine and the following one to the other side of the machine where sealing material is applied to the holes in which the welch plugs will be pressed. Movement of alternate heads to opposite sides of the transfer line allows a welch plug to be placed in opposite ends of successive heads and two welch plugs to be pressed in the side, thus making right and left-hand heads.

After passing through an idle station, the heads are again transferred to opposite sides of the transfer line where the three plugs are pressed in each

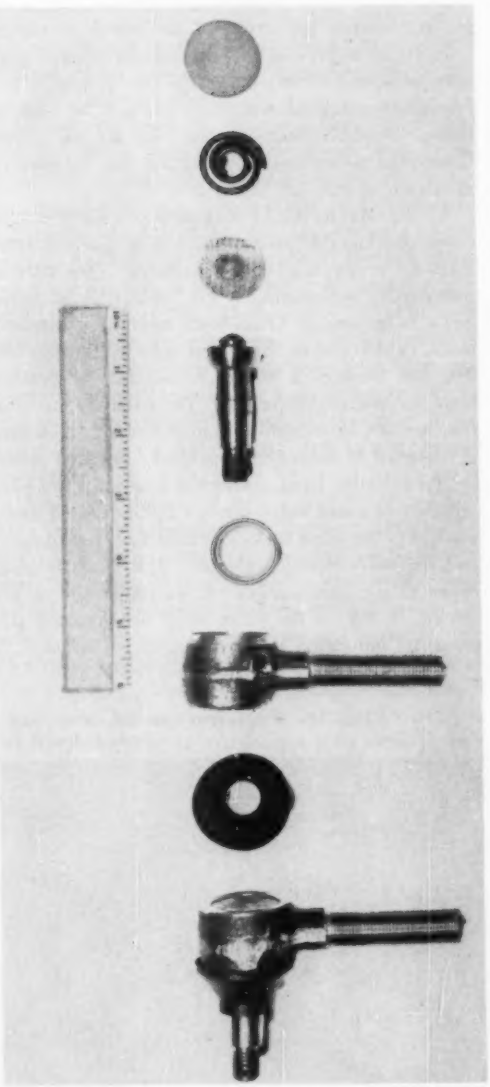


Fig. 9. Component parts of tie rod socket assembly. These are assembled on a special machine at Chevrolet-Buffalo Div., General Motors.

head, station four. Returning to the line, the heads are transferred forward and air tested in station five. Hydraulically operated overhead transfer bars remove rejects to the side of the line at station six. The same overhead transfer bars can be used to return repaired heads to the line at this point. Completed assemblies are unloaded onto a conveyor at station seven.

At the Mound Road Engine Plant of Chrysler Corp. considerable progress had been made in automatizing many assembly operations. One that is particularly outstanding is the installation of valve locks in a special Cross-built machine. Tapered, locks, cylindrical in shape and split lengthwise, are first run through a hopper to separate acceptable from non-acceptable parts. In the assembly machine they are fed by vibratory hopper down a track that is designed to accept only properly oriented parts.

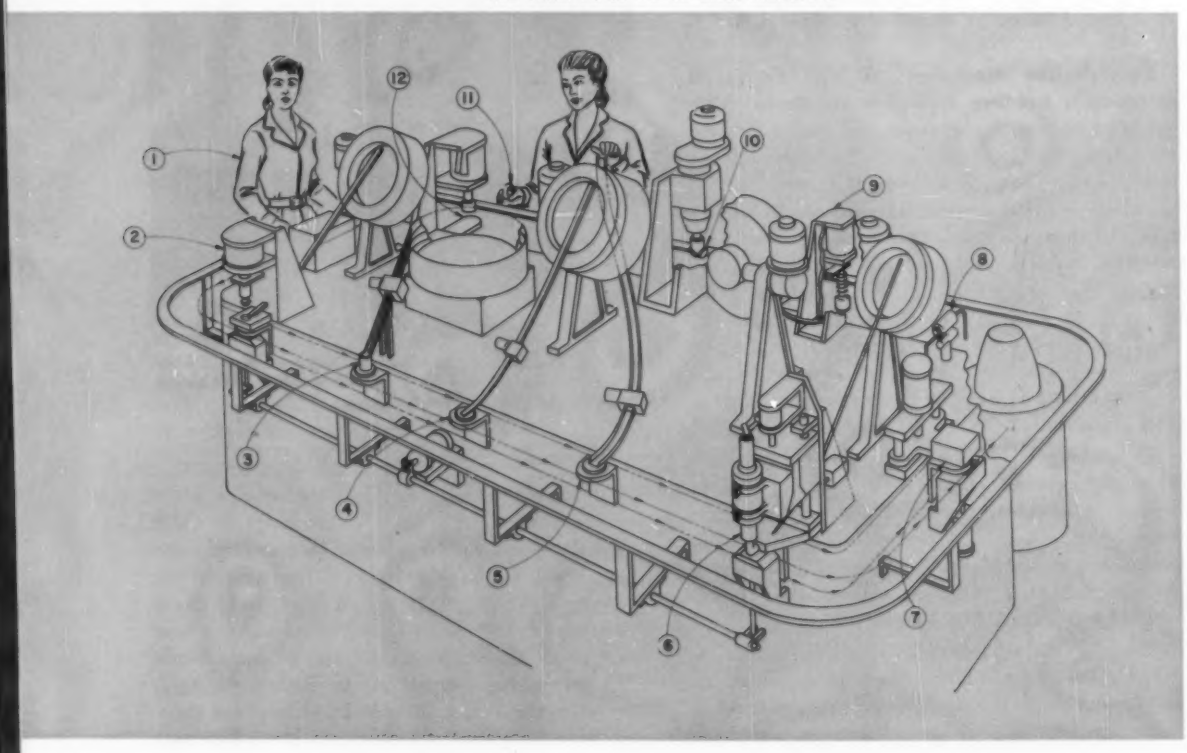
The cylinder head enters the assembly machine upside down and valve springs are depressed automatically, the valve locks positioned by feed fingers and the valve springs released. The head then indexes to the next station. A warning light is activated if any of the valve locks are inserted improperly, indicating that adjustment is needed.

Straight-line machines are often favored for assembly purposes as well as machining operations because of ease of access for maintenance and because floor-space requirements can often be held to a minimum. When holding fixtures or nests are used for transfer of the assembly from station to station, some means must be provided to return them from the last station back to the first station. This often requires extra floor space.

With small parts, one solution to the problem of returning the fixtures to the "load" position is the "over-and-under" type of transfer. Essentially, this consists of an endless conveyor which carries empty work-holding fixtures under the machine table to the loading point, *Fig.* 6. This type of transfer imposes some limitations on the number of stations feasible in one machine. It does, however, eliminate the extra floor-space requirements of rotary and oval track machines.

One of the largest integrated automatic assembly machines is that developed for the assembly of cylinder heads at Oldsmobile. The machine is of the straight-line type, 137 feet long, and is designed to assemble 400 cylinder heads per hour by indexing every nine seconds. Two seconds are required for

Fig. 10. Preliminary sketch of tie rod socket assembly machine. Number of stations was reduced to 11 in final machine.



each index, leaving a work time of seven seconds. Length of index is 23.48 inches.

Sixty-eight stations are provided. Eighteen of these are automatic, two are semiautomatic, 22 allow manual backup of automatic assembly stations, 15 stations provide maintenance access, four stations are required by a Kraus spring assembly machine, one station is used for loading and one station is idle. Five additional stations have been included in anticipation of future product design changes. There is sufficient space to completely assemble heads manually if necessary. A total of 75 parts is assembled into the cylinder head in this line.

Feeding is accomplished from hoppers and vibratory feeders and all stocking is done from the back of the machine. Where vibratory bowl feeders are used, stock is placed in bulk feed units over the bowl feeder. The stock level in the bowl feeders is automatically controlled.

Heads are automatically loaded into the machine. The first assembly operation is insertion of valves, which are loaded into the assembly fixture by an operator. After passing through several manual backup stations the head is turned over and loaded onto an assembly pallet. An air-cylinder operated station utilizing a vibratory feeder positions spark-plug gaskets. Passing through another manual backup station, the head arrives in position for spark-plug assembly. Four spark plugs are loaded into sockets of air wrenches. The wrenches swing in, assemble and tighten the plugs to the head. The station is air-cylinder operated. A special quick-change feature makes it possible to remove and replace the air tools without using wrenches or disconnecting the air lines.

In the next assembly station, sealer is applied to one pipe plug hole and two exhaust stud holes. Slides for the nozzles which apply the sealer are activated by the machine transfer bar. Following another manual backup and maintenance access station, five head bolts are installed. The bolt placement mechanism is actuated by the transfer bar, and bolts are bin fed. Three additional head bolts are installed in the next assembly station, which is actuated and fed in the same way. The next two stations are used to assemble and tighten two upper and two lower manifold studs. This station incorporates vibratory bin feeding and is air-cylinder operated.

Additional stations assemble and tighten one pipe plug and eight oil deflectors. The head then reaches the Kraus spring assembly machine where springs are automatically assembled to the head. Subsequently, valve spring retainers and valve keys are added to the head in two automatic stations. An electric gaging unit then checks all valves for proper key assembly. Heads with improperly assembled valve keys are repaired in the next active station, where a manually operated valve spring compressor is used. At the last station the cylinder head assembly is elevated by an air cylinder for automatic pickup by a power and free conveyor.

The machine was designed and built by the

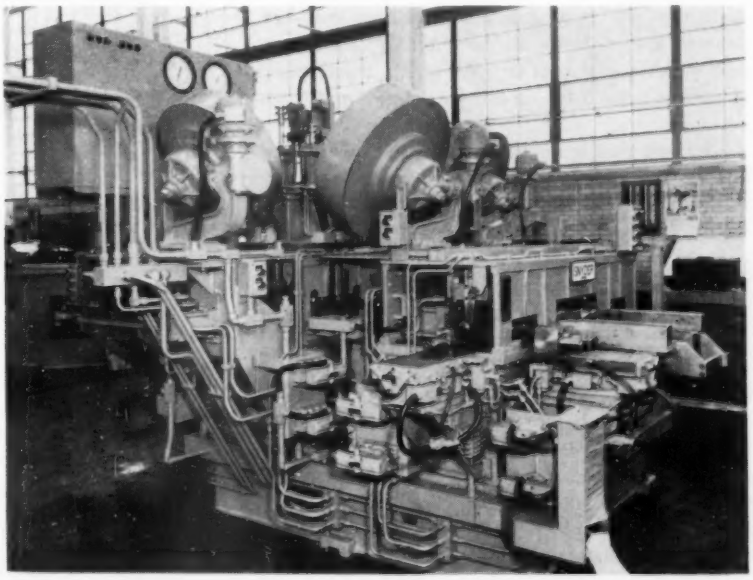


Fig. 11. Transfer type machine for assembling welch plugs to cylinder heads.

Process Development Staff at the General Motors Technical Center, in cooperation with Oldsmobile engineers. The transfer mechanism is operated mechanically. A 20-hp electric motor is run continuously and engaged to and disengaged from a crank arm, *Fig.* 12, through use of a Chevrolet truck clutch. This drive mechanism gives large stopping and starting forces, and controlled uniform acceleration and deceleration. To insure against down time, a completely independent sec-

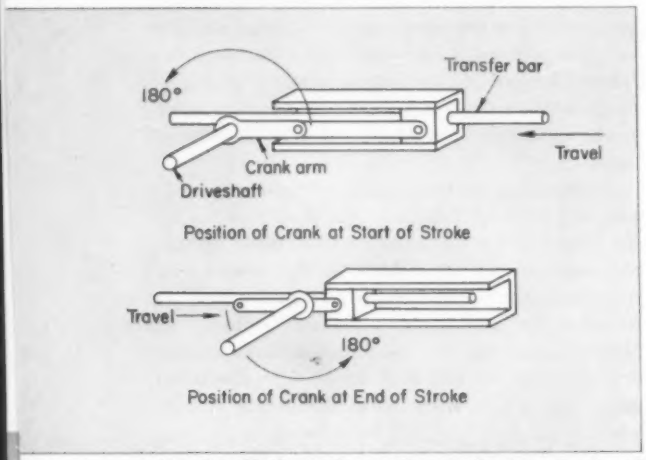


Fig. 12. Mechanical transfer mechanism developed for use in Oldsmobile cylinder head assembly machine. Crank travels 180 deg, thus providing controlled acceleration and deceleration.

ond drive unit is provided. This reserve unit can be conected in less than one minute. All valves and switches in the entire machine are immediately accessible for repair to minimize maintenance time.

Current Status of Automatic Assembly: The applications of automatic assembly which have been discussed are fairly typical of recent developments in this field. Many other examples could be cited.

It can be anticipated that the trend toward automaticity in assembly operations will take place at a faster rate than was the case with machining operations. Many of the essential elements of automatic assembly machines have already been developed, largely as a result of the emphasis on increased productivity in machining operations. There is no essential difference between feeding a part automatically to a machining operation and feeding it to an assembly operation. Satisfactory feeders and hoppers for such jobs have been developed and are available commercially. Air and hydraulic cylinders, and related actuating devices are standard items. Controlled-torque nut runners have been on the market for some time and, utilized in conjunction with suitable parts feeders, can readily be adapted to automatic operations.

To move parts from station to station, many types of indexing tables which provide precision positioning of parts can be readily procured. For in-line assembly machines, there are a number of satisfactory transfer mechanisms, and construction of a fully satisfactory transfer machine presents no new problems.

A host of electrical and electronic devices are available for machine control. Gaging and testing equipment in common use can be incorporated in assembly machines without substantial modification.

The current emphasis in automatic assembly is on machines which have adequate flexibility to allow for product changes and which can be utilized for the assembly of like products. Programmed assembly machines, capable of assemblying several product designs in accordance with magnetic tape or punched cards are in the offing. Product design engineers in many companies are working closely with tool engineers to develop component parts and assemblies which lend themselves to automatic assembly.

It is apparent from the applications described in this article that the tool engineering problems associated with automatic assembly can be reduced, in many cases, to combining commercially available machine components into an integrated machine capable of performing one or more assembly operations at the desired production rate. While special problems connected with positioning, feeding or holding parts which have complex or unusual shapes may be encountered, there is no doubt that they can be solved with existing technical know-how. Ingenuity and perspiration, rather than inspiration, are needed.

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hot work TOOL STEELS for Brass and Aluminum

CAREFUL SELECTION of the hot work tool steels used in hot forging and extruding brass and extruding aluminum is important to satisfactory die life. Data on the composition, heat treatment and hardness of such steels are contained in the accompanying tables. Additional factors affecting die life are listed in a previous reference sheet, THE TOOL ENGINEER, Oct., 1956, along with data on hot work tool steels for other materials.

Table 1—Brass Forging Dies and Punches

Composition							Heat Treatment				Hardness
C	Mn	Si	Cr	V	W	Mo	Preheat (F)	High Heat (F)	Quench Medium	Draw (F)	Brinell (No.)
0.35	0.45	1.00	5.00	0.45/100	—	1.40	1400	1800	Air	1100	400/450
0.35	0.45	1.00	5.00	—	1.35	1.70	1400	1800	Air	1100	400/450
0.35	0.30	1.00	5.25	—	5.25	0.30	1400	1950	Air	1175	400/450
0.30	0.25	0.30	3.25	0.30	9.00	—	1400	2150	Air	1200	400/450
0.40	0.30	0.35	3.25	0.40	11.00	—	1550	2150	Oil & Air	1225	400/450
0.45	0.30	0.35	3.50	0.50	15.00	—	1550	2200	Oil & Air	1250	450/500*
0.50	0.30	0.35	4.00	1.00	18.00	—	1550	2200	Oil & Air	1250	450/500*

* Usually limited to punch applications where maximum red hardness and wear resistance are necessary.

Table 2—Brass Extrusion Dies for Rods and Tubes

Composition											Heat Treatment				Hardness
C	Mn	Si	Cr	V	W	Mo	Co	Ni	Fe	Ti	Preheat (F)	High Heat (F)	Quench Medium	Draw (F)	Brinell (No.)
0.35	0.30	1.00	5.25	—	5.25	0.30	—	—	—	—	1500	1950	Air	1200	350/375
0.40	0.30	0.35	3.25	0.40	11.00	—	—	—	—	—	1500	2150	Oil & Air	1250	350/375
0.40	0.30	0.35	3.25	0.40	11.00	—	3.50	—	—	—	1500	2150	Oil & Air	1250	350/375
0.45	0.30	0.35	3.50	0.50	15.00	—	—	—	—	—	1500	2200	Oil & Air	1275	350/375
0.60	0.30	0.30	3.75	1.10	1.50	9.00	—	—	—	—	1550	2200	Oil & Air	1275	350/375
0.50	0.30	0.35	4.00	1.00	18.00	—	—	—	—	—	1550	2300	Oil & Air	1350	350/375
0.35	0.35	0.50	12.00	1.00	12.00	—	—	—	—	—	1550	2350	Oil & Air	1380	350/375
2.25	—	—	33.00	—	17.00	—	44.00	—	2.00	—					— *
0.30	1.00	0.50	19.50	—	1.25	1.60	—	10.75	—	0.75					250/280†

* Cast alloy—not heat treated. Suited to abrasive and difficult to extrude alloys.

† Hardened by hot and cold working.

Table 3—Brass Extrusion Dies for Shapes

Composition								Heat Treatment				Hardness
C	Mn	Si	Cr	V	W	Mo	Co	Preheat (F)	High Heat (F)	Quench Medium	Draw (F)	Brinell (No.)
0.35	0.30	1.00	5.25	—	5.25	0.30	—	1500	1950	Air	1275/1300	300/375
0.40	0.30	0.35	3.25	0.40	11.00	—	—	1500	2150	Oil & Air	1325	300/375
0.40	0.30	0.35	3.25	0.40	11.00	—	3.50	1500	2150	Oil & Air	1325	300/375
0.45	0.30	0.35	3.50	0.50	15.00	—	—	1500	2200	Oil & Air	1350	300/375
0.60	0.30	0.30	3.75	1.10	1.50	9.00	—	1500	2200	Oil & Air	1350	300/375

Table 4—Backer Blocks and Holders

Composition								Heat Treatment				Hardness
C	Mn	Si	Ni	Cr	V	W	Mo	Preheat (F)	High Heat (F)	Quench Medium	Draw (F)	Brinell (No.)
0.50	—	—	1.75	0.65	—	—	0.35	1200	1525	Oil	750	400/450
0.50	—	—	—	1.00	0.20	—	—	1200	1650	Oil	750	400/450
0.50	0.30	1.10	—	1.75	0.25	2.50	0.50	1200	1750	Oil	1225	425/450
0.35	0.30	1.00	—	5.25	—	5.25	0.30	1400	1950	Air	1125	425/450
0.30	0.25	0.30	—	3.25	0.30	9.00	—	1400	2150	Air	1125	425/450

Table 5—Cutoff Knives

Composition								Heat Treatment				Hardness
C	Mn	Si	Ni	Cr	V	W	Mo	Preheat (F)	High Heat (F)	Quench Medium	Draw (F)	Brinell (No.)
0.35	0.30	1.00	—	5.25	—	5.25	—	1400	1950	Air	1050	475
0.30	0.25	0.30	—	3.25	0.30	9.00	0.30	1500	2150	Air	1150	475
0.40	0.30	0.35	—	3.25	0.40	11.00	—	1500	2150	Air	1150	475

Data furnished through the courtesy of H. E. Replogle, Universal-Cyclops Steel Corp., Bridgeville, Pa.

The primary factor in the selection of hot work tool steels is their ability to stand up under conditions found in specific applications. Accordingly, these steels have been grouped in the tables according to type of application.

The applications for brass forging dies and punches, TABLE 1, are obvious. Choice of steels for brass extrusion, TABLES 2 and 3, depends on the shapes to be extruded, type and temperature of the metal extruded and anticipated length of the production run. When hard and abrasive metals are extruded, steels with high red hardness and high resistance to abrasion should be selected.

Backer blocks and holders, TABLE 4, are used to hold and back up dies. Such backers and holders should fit well or dies will be subjected to unnecessary stresses which may cause breakage.

The function of cutoff knives, TABLE 5, is to shear butts of hot billets from extruded material. Dummy blocks, TABLE 6, are in direct contact with hot billets and directly transmit the pressure needed for extrusion. They are used in rotation in sets of six or seven. Tube extrusion mandrels, TABLE 7, perform the first piercing operation on billets and then act as mandrels around which metal is extruded through a die.

Tube approach dies, TABLE 8, are placed ahead of tube extrusion dies. By relieving extrusion dies of 100 percent face contact with billets, they assure lower extrusion die operating temperatures. Piercing of solid billets is accomplished by piercer points, TABLE 9. The points are screwed to a long horizontal bar which is rotated rapidly. The billet is rotated in the opposite direction and the piercer point is forced through the billet to make a complete longitudinal hole.

The same types of extrusion press and tools are used for extruding aluminum as for extruding brass. Since extrusion temperatures are much lower, hot work tool steels for aluminum need not be as highly alloyed as those used for brass. All tools, extrusion dies, dummy blocks, mandrels and other die componets required are made from only one type of hot work tool steel, TABLE 10.

Table 6—Dummy Blocks

Composition							Heat Treatment				Hardness
C	Mn	Si	Cr	V	W	Mo	Preheat (F)	High Heat (F)	Quench Medium	Draw (F)	Brinell (No.)
0.35	0.45	1.00	5.00	0.45	—	1.40	1400	1800	Air	1125	400/425
0.35	0.45	1.00	5.00	—	1.25	1.70	1400	1800	Air	1125	400/425
0.35	0.30	1.00	5.25	—	5.25	0.30	1400	1950	Air	1150	400/425
0.30	0.25	0.30	3.25	0.30	9.00	—	1400	2150	Air	1150	400/425
0.40	0.30	0.35	3.25	0.40	11.00	—	1500	2150	Air	1250	350/400

Table 7—Tube Extrusion Mandrels

Composition							Heat Treatment				Hardness
C	Mn	Si	Cr	V	W	Mo	Preheat (F)	High Heat (F)	Quench Medium	Draw (F)	Brinell (No.)
0.35	0.45	1.00	5.00	0.45	—	1.40	1400	1800	Air	1100	400/450*
0.30	0.25	0.30	3.25	0.40	9.00	—	1400	2150	Air	1150	400/450†

*Good for water-cooled press mandrels. †Good for oil-cooled press mandrels.

Table 8—Tube Approach Dies

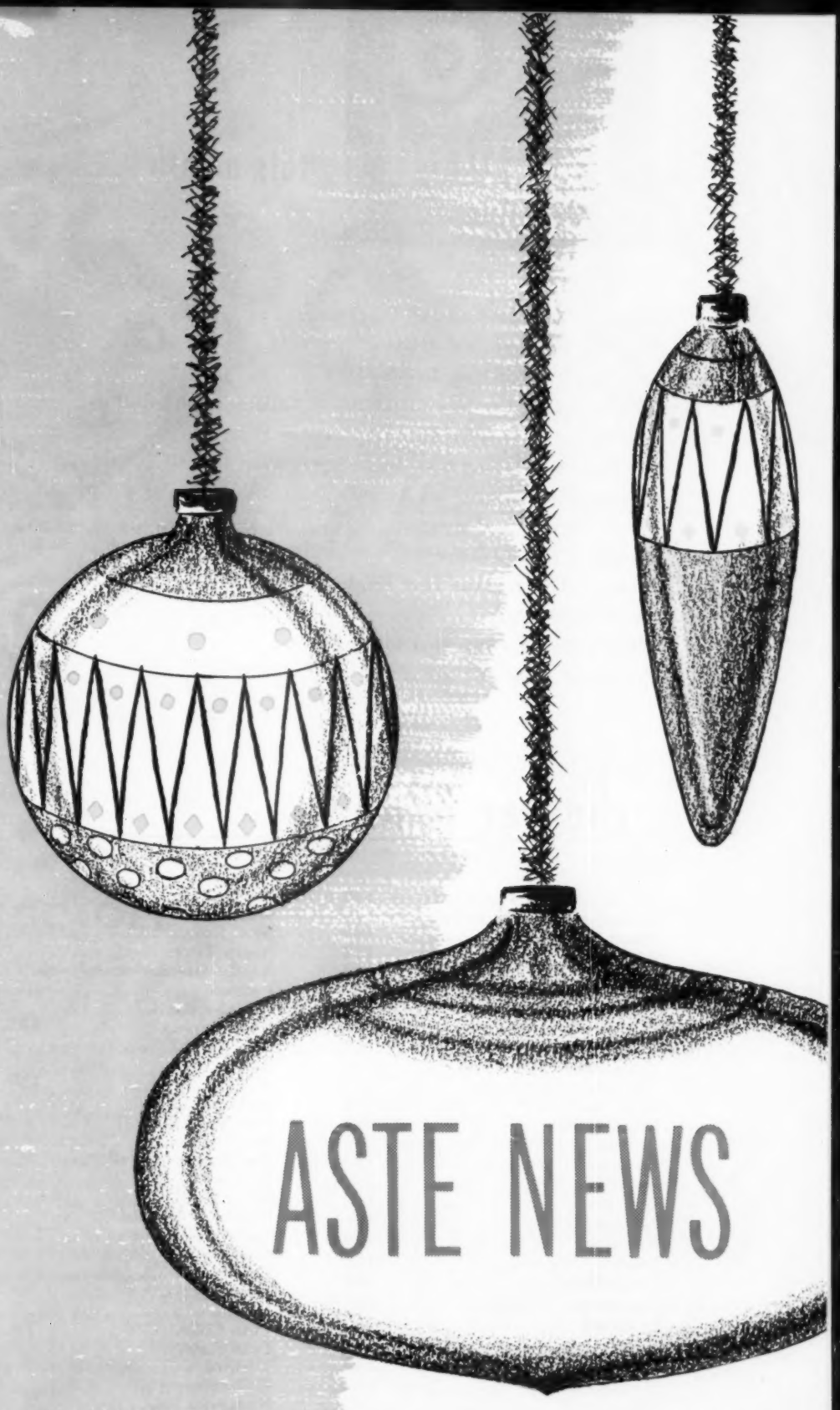
Composition						Heat Treatment				Hardness
C	Mn	Si	Cr	V	W	Preheat (F)	High Heat (F)	Quench Medium	Draw (F)	Brinell (No.)
0.50	0.30	0.35	4.00	1.00	18.00	1550	2350	Air	1350	Abt. 375

Table 9—Piercer Points

Composition								Heat Treatment				Hardness
C	Mn	Si	Cr	V	W	Ni	Mo	Preheat (F)	High Heat (F)	Quench Medium	Draw (F)	Brinell (No.)
0.55	0.35	1.15	4.75	0.50	—	—	5.25	1550	2200	Air	1200	400/450
0.25	0.40	0.40	2.75	—	9.00	—	—	1500	2150	Air	1225	350/400
0.40	0.30	0.35	3.25	0.40	10.00	2.00	—	1500	2150	Air	1225	350/400
0.45	0.20	0.35	3.50	0.40	15.00	—	—	1500	2200	Air	1350	350/400
0.50	0.30	0.35	4.00	1.00	18.00	—	—	1500	2300	Air	1300	350/400

Table 10—Steel for Aluminum Extrusion

Composition						Heat Treatment				Hardness
C	Mn	Si	Cr	W	Mo	Preheat (F)	High Heat (F)	Quench Medium	Draw (F)	Brinell (No.)
0.35	0.45	1.00	5.00	1.25	1.70	1200	1800	Air	1100	425/450



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President McMillen, left, administers the oath of office at the installation of ASTE's new directors: John X. Ryneska, Philip R. Marsilius, Leslie Seager, Joseph L. Petz, Gustave B. Berlien, and Irving H. Buck.

semiannual meeting of Directors

ASTE's Board of Directors seminnual meeting in White Sulphur Springs, West Virginia was characterized by enthusiastic approval and appreciation of the excellent work being carried out by ASTE's national committees. Under the chairmanship of Howard C. McMillen, national president, sessions opened on October 25 at The Greenbrier.

Mr. McMillen, in his opening remarks, said: "The real progress of the Society cannot be measured entirely in terms of total membership, or in terms of plans and programs carried out or objectives realized.

"The true yardstick of progress is service; service to individual tool engineers by helping them advance in their chosen field; service to industry as a whole by advancing the standards of the tool engineering profession and by developing and disseminating tool engineering know-how. This kind of progress cannot be pinpointed for the purposes of a periodic report, but it has been one of the important factors in advancing American productivity and, with the growth of the Society, will become even more important in the future."

New Directors Installed

Semiannual meetings are traditionally concerned with receiving reports of committees and officers, approving budgets and programs for the coming year, and reports and recommendations of the House of Delegates.

In addition to these considerations the Board elected a new member to the Research Fund Committee, elected the Research Fund Committee chairman, and appointed nominating committees.

Preceding these activities six new directors who were elected last March by the House of Delegates, were installed. They were Joseph L. Petz, Gustave Ben Berlien, Irving H. Buck, Leslie C. Seager, Philip R. Marsilius and John X. Ryneska.

Recognizing the desirability of a man experienced in research and research administration as a member of the ASTE Research Fund Committee, the Board named Dr. George Andrew Hawkins, dean of engineering at Purdue University, to serve on the committee.

Listening to deliberations by the Board, national committee chairmen are: from left, John E. Rotchford, Standards; Francis J. Sehn, Books; Edmund Hollingsworth, Program; Wilfred B. Wells, Public Relations; and H. Verne Loeppert, Membership Committee.

SEMIANNUAL MEETING

Participating in the semiannual meeting, from left, were: Philip Marsilius, Leslie C. Seager, William A. Thomas, John X. Ryneska, Charles M. Smillie, Allan Ray Putnam, H. Dale Long, H. E. Collins, Howard C. McMillen, Harry E. Conrad, George A. Goodwin, Wayne Ewing, H. B. Osborn, Jr., Gustave B. Berlien, William Moreland, Joseph L. Petz, and Irving H. Buck.

Dr. Hawkins' experience fits him admirably for helping this active group plan research projects which must be scientifically sound and at the same time be of real interest and potential value to industry.

James R. Weaver, newly elected chairman of the Research Fund Committee will succeed Robert B. Douglas. Mr. Weaver is manager of manufacturing and engineering for Westinghouse Electric Corp., Springfield, Mass. He has been a member of the Society for nearly 20 years and served as president and chairman of the Board in 1939-40.

Nominating Committee Named

President McMillen named members of the nominating committees for officers and directors with the approval of the Board. Dr. Harry B. Osborn, Jr., immediate past president of the Society, heads both committees.

Serving with him on the nominating committee for directors are: Joseph L. Petz, member of the National Editorial Committee; Carl J. Oxford, Jr. of the National Education Committee; Roy O. White, member of the National Constitution and By-Laws Committee; and Louis Jensen of the National Standards Committee.

Named with Dr. Osborn to the nominating committee for officers are: William A. Thomas and Charles M. Smillie. Each is a national director.

Among actions passed by the Board was the renaming of the National Book Committee to "National Technical Publications Committee." In addition, the Directors approved the purchase of six additional prints of the 15-minute color motion picture of the 1956 Exposition and Convention.

National committee chairmen pictured above are: Frank J. Hausfeld, Jr., Finance; T. Bert Carpenter, Judicial; Frank W. Curtis, vice chairman of Honor Awards, who sat in for Board Member and Chairman James R. Weaver. Vincent M. Spahr, Constitution and Bylaws; V. H. Gallichotte, Professional Engineering Committee; and Robert E. McKee, Education.

Dean of Engineering Named to Research Fund Committee

Dr. George A. Hawkins, elected by ASTE Board of Directors to serve as a member of the Research Fund Committee, is dean of engineering, Purdue University, and has made wide contributions to the engineering profession both as a writer and as a professor.

He is currently serving as engineering consultant to the National Science Foundation.

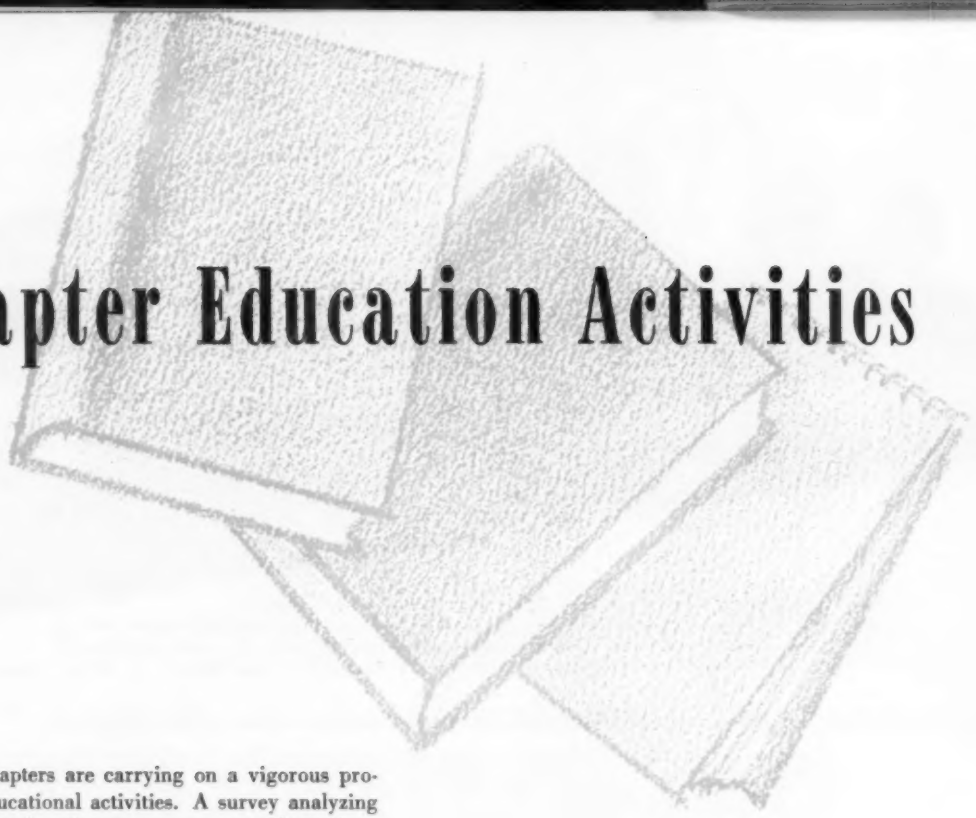
In 1953, Professor Hawkins was named dean of engineering. Among his duties as dean of engineering is the directorship of the Purdue Engineering Experiment Station.

He is author or coauthor of several leading textbooks on heat transfer and thermodynamics. For his specialized work on viscosity, particularly of steam at high temperatures, he has won recognition.

From 1941 to 1951 Professor Hawkins had charge of the Ordnance Research Program on the Purdue campus. At present, he is a director of ASME assigned to technology.

Professor Hawkins adds his experience to that of the present committee members, who are: James R. Weaver, chairman, manager of manufacturing and engineering of Westinghouse Electric Corp.; Kenneth R. Beardslee, general manager of Metallurgical Prod. Dept., G. E.; Wallace E. Carroll, president of American Gage & Machine Co.; Dwillard J. Davis, vice president of mfg., of Ford Motor Co.; William E. Mahin, consultant; Dr. Daniel J. Martin, vice president of engineering of the Hughes Tool Co.; Louis F. Polk, president, Sheffield Corp.; Joe Sunnen, president of Sunnen Products Co.; and Gervais W. Trichel, president, Amplex Div., Chrysler Corp.

Chapter Education Activities



ASTE chapters are carrying on a vigorous program of educational activities. A survey analyzing this chapter education program was made by Professor Frederick Preator who is head of tool engineering at Utah State Agricultural College, and a member of the National Education Committee.

Results show that more than $12,000 has recently been devoted to scholarships. The combined total of awards and scholarships represents a cash investment of $13,223.50 from chapters.

These scholarships have enabled 36 students to attend colleges or universities, seven to attend technical institutes, and two, high schools.

Most of the scholarship winners were selected by the chapter education committee meeting with local school officials. However, in some instances, such committees as the education or executive, or special scholarship committee, chose the winners.

Additional chapter educational activities included the sponsorship of 50 extension courses by 14 chapters, on such subjects as tool design, materials, planning and costs.

Chapter Education Activity

	Number	Percent
Chapters contacted	125	100
Chapters replying	70	56
Chapters reporting some type of education activity	45	36
Chapters reporting scholarships or awards or both	30	24

	Number	Total
Scholarships awarded (value $50 to $1200 each)	45	$12,276.50
Awards given (value $5 to $100 each)	57	947.00
Total	102	$13,223.50

HOUSTON PLANTS
open doors for tours

This photograph shows the flash-welding of tool joint to pipe, the guard being removed for the picture. The process for utilizing drill pipe and tool joints was developed by Hughes Tool Co., and the first "Flash Weld" tool joints made available to industry in 1938.

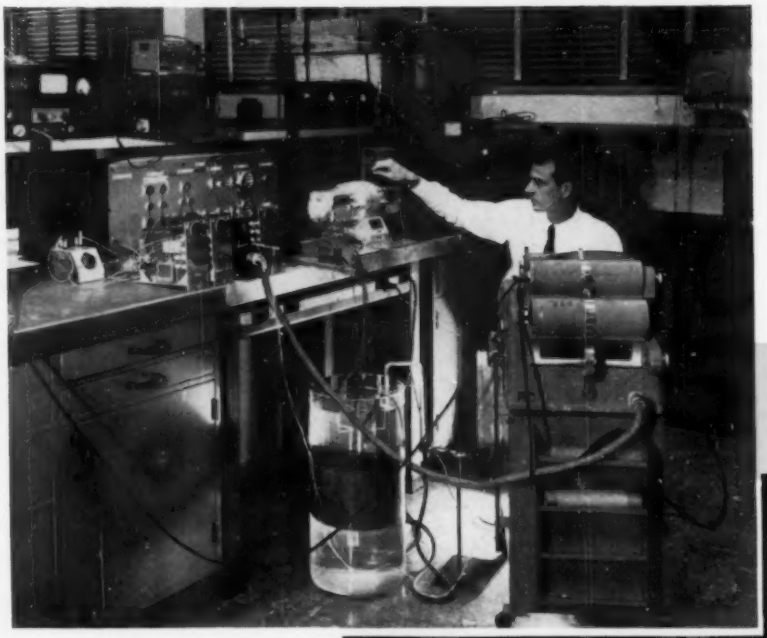
Texas industry should prove highly appealing to convention-week visitors planning to participate in the plant-tour program that has been arranged by the Houston Host Committee for the Silver Anniversary Celebration in March.

The oil industry, Texas' life blood, casts its influence on many of the products manufactured by the six plants to be visited. Also on the agenda, a trip to an operating oil well drilling rig will add a truly Texas flavor.

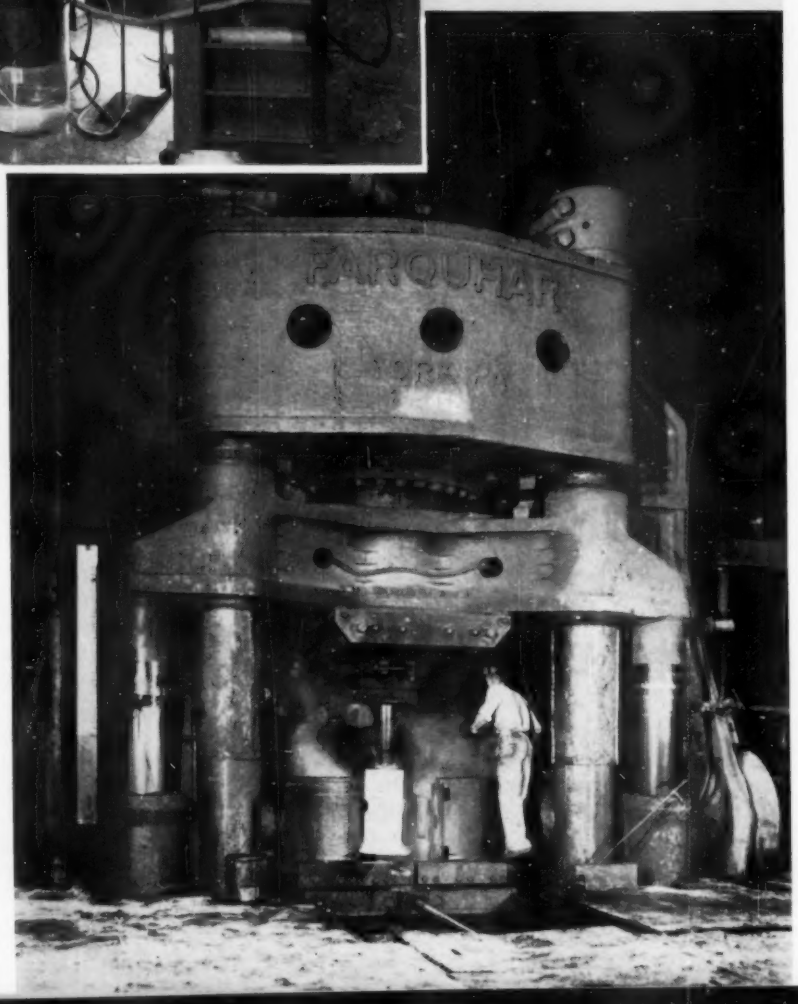
The variety of processes that can be viewed on these tours ranges from a power-packed split-die forging operation performed by an 11,000-ton press that stands six stories high, to the delicate nuclear physical measurements needed to determine the nature of geological formations at the site of proposed oil wells.

Another comparison to be seen is that of manpower on the assembly line contrasted to Univac's completely automatic control of production.

Houston plant

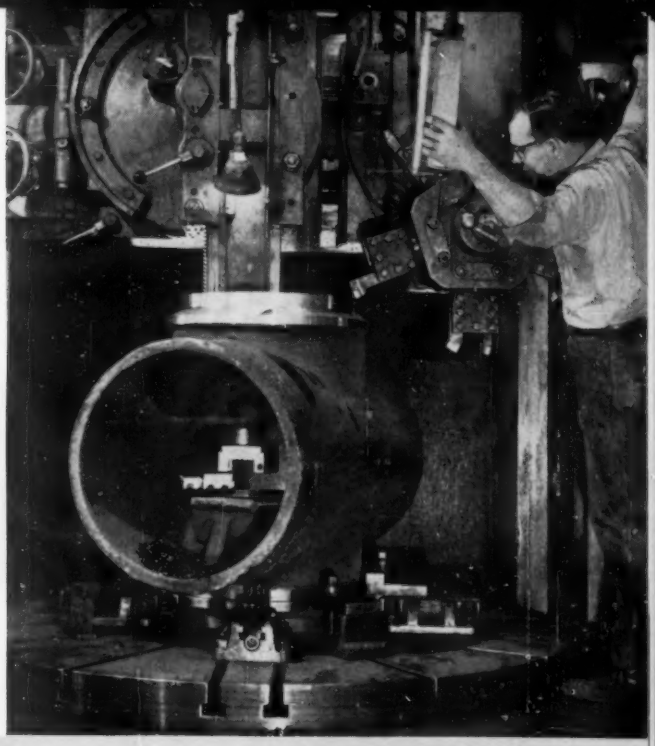


Above is one of twelve laboratories that Houston convention-goers will see at Schlumberger Well Surveying Corp. In these labs it is possible to reproduce conditions very nearly like those in the field, through which accurate estimates of gas or oil production can be made.

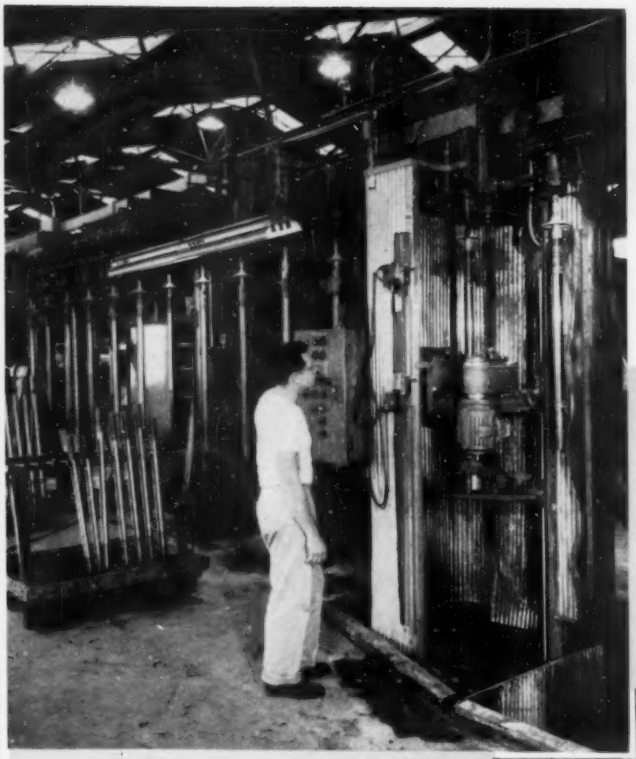


At the Cameron Iron Works' 100-acre plant site, this 8000-ton split die forging press has just completed a well-head forging. Every step in the manufacture of high-quality alloy steel is performed here, from molten steel to final assembly.

tours



Here, a through-conduit valve body is being machined on a large vertical boring mill at W.K.M. Mfg. Co. In the new 12-acre plant at Missouri City, the Univac 60 makes possible production scheduling on a demand, rather than product line, basis.

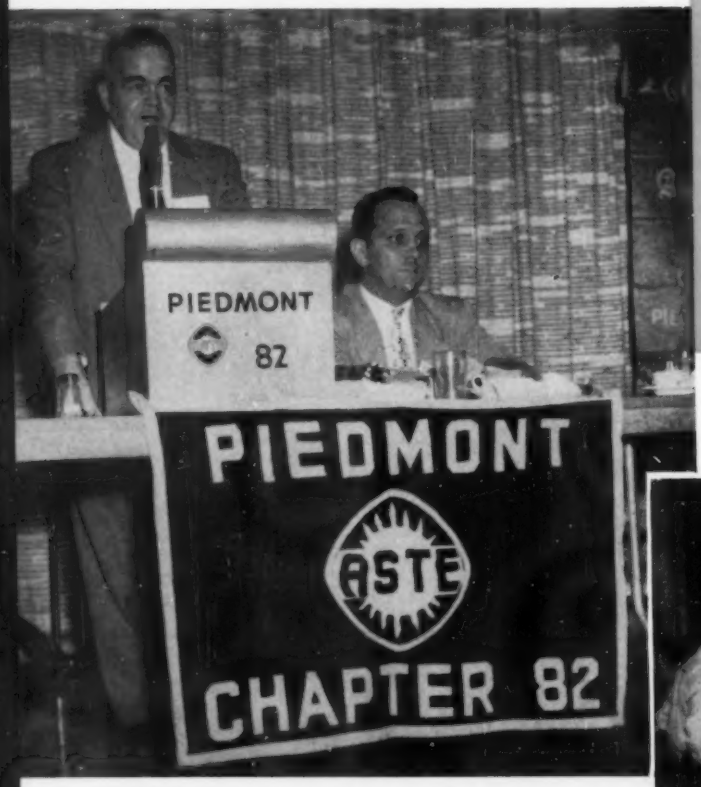


At Mission Mfg. Co., vertical polishing heads for pump rods are shown prior to liquid honing. The world's largest producer of slash pump parts has successfully adapted short-run job-shop lots of these parts to mass-production techniques.

This special 9-spindle, 4-station rotary index machine is used by Reed Roller Bit Co. for milling teeth in rock bit cones. Organized in 1916 to produce a cross-roller type rock bit, the company has been active in developing improved well-drilling tools.

Metalworking Conference at North Carolina State

Pictured at the Bolden Die Supply Co. exhibit are: William E. Shaw of Western Electric, left, and C. S. Daniel of the Bolden Die Supply Co.



Robert Blackburn, speaker for the student luncheon, is shown as he addressed the group on the subject, "Opportunities for Engineers in Industry." Left to right are: Edwin Zagora and Albert Fairchild, both of Piedmont chapter.

An over-all view of the exhibition area is shown here with the George A. Marshall Machinery Co. and Western Electric Co. exhibits in the foreground.

"Manufacturing Procedures in the Metalworking Industries" was the theme of the Piedmont-sponsored conference held on the North Carolina State college campus October 5. Two hundred seventy five attended the event, which was cosponsored by the college's engineering school and extension program, and the newly formed Raleigh-Durham chapter.

Keynoting the event was a proclamation by Governor of the State Luther H. Hodges, designating Friday, October 5, as Tool Engineers Day in North Carolina, because of the significance of the occasion to the present and future economy of the state.

The general arrangements for this highly successful conference were made by a committee of 16, headed by Sidney B. Jeffreys, past chairman of Piedmont chapter, and included Professor Charles Lasater of the National Education Committee and Dean J. H. Lampe of the school of engineering. The well-attended sessions covered machine selection and replacement, design and maintenance of small dies, new concepts in single-point turning, tooling of multislide machines, high-speed turning, improvement of machined surfaces through vibration control, and mechanical finishing with rotofinish.

Robert E. McKee, chairman of ASTE's National Education Committee, extended greetings from the national officers and directors to the two hundred and twenty five present at the banquet held Friday night in the Sir Walter Hotel. He gave a second talk at the student luncheon, attended by 120, on the following day, directing his remarks to the student guests in the audience.

The Raleigh meter plant of Westinghouse Electric Corp. opened its automatic screw machine, gear cutting, punch press and assembly sections to the conferees. Campus tours included an inspection of North Carolina's nuclear reactor and engineering laboratories.

Technical sessions began at 10 a.m. Friday at Riddick Hall, and continued after the opening luncheon with two groups of two optional sessions proceeding simultaneously at 1:30 and 3 p.m. The two final sessions were held at 9 and 10:45 a.m. Saturday.

For those pigskin fans who wished to attend, North Carolina's "Wolfpack" played the Clemson College "Tigers" later that night.

Shown at the Westinghouse Meter Plant exhibit are Clyde C. Shannon, left, Edna Mitchell, and Janice Broadwell operating the semiautomatic assembly and gaging machine.

Piedmont and Raleigh-Durham officials greeting guest Robert McKee, fifth from left, are: A. R. Fairchild, C. Shannon, S. B. Jeffreys, and E. N. Dietler. Others are E. Zagora, J. Reilly, and R. Schneider.

Student Group Chartered
at University of Wichita

Howard McMillen, ASTE national president, congratulates University of Wichita Chairman. John McCool, shown accepting the charter.

On September 24, the fourteenth student chapter of ASTE was established at the University of Wichita. Originated under the auspices of the local Wichita chapter during the 1953-54 school year, the group has grown sufficiently in strength and numbers to become a separate entity.

The chartering program opened with Wichita Chairman Norman Watkins introducing John McCool, chairman pro tem of the student group, who delivered a welcoming speech.

Bill Unruh, Wichita's program chairman, and toastmaster of the evening, presented Howard C. McMillen, ASTE national president, who administered the oath of office to the new officers.

Main speakers for the evening were Dr. James K. Sours, dean of students; Professor J. W. Dunn, head of the mechanical engineering department; and Professor B. M. Aldrich, also of that department, and faculty adviser to the student chapter. Professor Aldrich extolled the activities of the ASTE, and described the benefits to be derived from having a student chapter on the campus.

On hand for the event were Orville Strahm, of the National Membership Committee, and Marvin Bunting, ASTE staff administrator, who presented the first check to the chapter treasurer.

Visitors at the chartering ceremonies are, from left: Orville Strahm, National Membership Committee; H. C. McMillen, National President; and Roy O. White, National Constitution and Bylaws Committee.

Shown below with their faculty adviser Prof. Aldrich and President McMillen, center, are new officers Bernard Schult, Robert Moffett, Gene Maxon, John McCool, James Shafer, and Hubert Brockman.

Tooling and Gaging Institute

at University of Toledo

Basic considerations of "Tooling and Gaging in Automation" were discussed at Northwest Ohio's first tool engineering institute on September 29. Held on the University of Toledo campus, the conference was sponsored jointly by Toledo chapter and the university.

After their arrival at the student union and preliminary coffee, one hundred and fifty registrants were welcomed to the institute by dean of engineering Dr. Edwin D. Harrison.

The morning session, moderated by Herbert T. Tigges, past national president of ASTE, was devoted to the application of inspection techniques to automation. Three panelists discussed the how, when and why of gaging, followed by an active question and answer period.

Luncheon in the university dining hall featured brief talks by Dr. Asa S. Knowles, president of the university; the Honorable Ollie Czelusta, Toledo's mayor; and Howard C. McMillen, national president of ASTE, to whom the mayor presented a glass key to the city.

Following the luncheon, a tour of exhibits was scheduled in the field house. The gaging equipment set up there represented nearly all of the leading manufacturers in this field.

The afternoon session introduced Jack Siekmann of Carboloy Division, General Electric, describing the Gilbert computer, and discussing factors which affect cutting tool life. The program was concluded with an illustrated talk on toolholders and presetting fixtures used in automation, given by Harry Conn of Scully-Jones & Co.

Toledo's Mayor Ollie Czelusta is shown presenting President H. C. McMillen with a glass key to the city.

Exhibits of gaging equipment set up in the university field house are inspected by institute-goers. The many exhibits represented nearly all of the leading equipment manufacturers in the field.

NORTH TEXAS SPONSORS

first tooling conference in area

Four segments of Texas industry participated in the North Texas area's first "Conference for Tool Engineers," by providing technical session speakers and sponsoring the student guests who attended. The conference took place on the campus of Arlington State College, midway between Fort Worth and Dallas. Sponsoring it was ASTE's North Texas chapter, in cooperation with the college.

Representatives from Bell Aircraft, Convair, the Texas Instrument Co. and Chance Vought Aircraft made the daytime technical sessions both interesting and informative. Highpoint of the evening's activities was a stirring address on "Construction vs. Destruction" by General J. Earl Rudder, land commissioner of Texas and brigadier general of the 90th Reserve Division.

Conferees began the day with a tour of the engineering and manufacturing classes, the trip ending in the main auditorium where they were welcomed to the campus by E. W. Hereford, president of Arlington State. In the first technical session, R. L. Lichten, chief experimental project engineer with Bell Aircraft, Hurts, Texas, spoke on the development of the Bell Convertiplane.

Luncheon Speaker R. K. May, general supervisor of manufacturing research and development at Convair, Fort Worth, gave an informative lecture on the latest developments in the bonding and brazing of honeycomb panels.

The subjects covered in the afternoon sessions were: work simplification as a tool in industry, presented by D. H. Carpenter, head of methods improvement at Texas Instrument Co.; and the challenge to develop tooling for meeting aircraft production requirements, covered by D. W. Kraybill, chief tool project engineer of Chance Vought Aircraft.

Presiding over the postdinner meeting was F. Paul Simpson, North Texas chapter chairman, who presented G. E. Smith, head of Arlington's engineering department, with a *Tool Engineers Handbook*, a *Die Design Handbook*, and a subscription to THE TOOL ENGINEER. National Director Irving H. Buck reported on the current "State of the Art," before presenting the main speaker of the evening, General Rudder.

INTERNATIONAL EDUCATION AWARDS

Again this year the American Society of Tool Engineers will offer its International Education Awards, totalling $7,000, to ten outstanding engineering students in recognized schools in the United States and Canada.

All ASTE members are urged to encourage students in their chapter's area to apply for the awards. Application forms, which are available at national headquarters, should be submitted to ASTE National Education Committee before February 15.

Selection of award winners will be made from information on the application, plus recommendations of a screening committee, composed of faculty members and the local chapter education committee.

To be eligible for awards, students must be taking full-time courses in preparation for future work in tool and production engineering. They must be in the third year of a four-year curriculum, the third or fourth year of a five-year curriculum, or a senior planning to do post-graduate work.

members on the MOVE

Theodore Borecki of Long Island chapter has resigned his position in industry to accept full-time post of assistant professor of the newly organized industrial engineering department at Pratt Institute in Brooklyn, N. Y.

Charles A. Laurie, member of North Texas chapter, has been appointed general manager of the Machine Tool Sales Co. and vice president and a member of the board of the Tool Supply & Engineering Co.

Raymond A. St. John of Detroit chapter has been appointed general sales manager of the Heald Machine Co., Worcester, Mass.; and Albert A. Arbogast of Indianapolis chapter will assume Mr. St. John's post as Detroit branch manager.

Charles M. Hawkins of St. Louis chapter has been appointed general manager of Ehrhardt Tool & Machine Co.

Anthony J. Snyder, Boston chapter, has been named assistant to the vice president sales, of Firth Sterling, Inc.

Walter Nollenberger of Pontiac chapter was appointed manager of a new manufacturing plant to be built in Lexington, Ky. by the Square D. Co.

Three Toledo members were elected to the national directorate of the Pressed Metal Institute: **Walter Baird, Philip Wood,** and **William Klaus.**

Rudolph Lorenz, Jr. of Binghamton, has been appointed staff engineer in product engineering in the Endicott Product Dev. Lab.

Two Tri-Cities members received appointments: **Harold Redshaw** was named general sales manager; and **Robert Mundt** is now chief tool designer.

Endicott's IBM plant has announced the appointment of two Binghamton members to new positions. **Paul J. Adamek,** is now manager of the Automated Plugwire Mfg. Dept. first shift. **Donald R. Wykstra** has been made manager of the second shift departments of Die Repair, Tool Design, Machine Tool Stores, Cutter Grinding, and Die Stores.

Rockford chapter's **Russel V. Ringquist,** formerly with Firth-Sterling Steel Co. of Pittsburgh, has been appointed field applications engineer in the midwest area for Firth-Loach Metals, Inc. of McKeesport.

The Dumore Co. of Racine announces the appointment of **Jack W. Woodward,** North Texas chapter, as southwest manufacturer's representative of automatic drilling equipment.

Gene R. Voight, who received the 1954 service award from the St. Louis chapter, has been promoted by the Aro Equipment Co. of Bryan, Ohio, to sales manager of its Air Tool Division.

Milton Bates, Fond du Lac chapter member, has moved to the Pate Oil Co., Milwaukee, as sales engineer, from his former position as lubrication engineer for the Wisconsin Axle Div. of Rockwell Spring and Axle Co. in Oshkosh.

Many Tri-Cities chapter members have been on the move recently. Pioneer-Central Div. of Bendix Aviation Corp. announces the promotions of **E. J. J. Burke** to carbide tool coordinator, **Hobert Russell** to toolroom foreman, and **Richard Henneman** to tool engineer.

GREATER NEW YORK—British toolmakers making a tour of U. S. industry are shown with Chapter Chairman William Reber, center. From left, they are George A. Bennett, Talbot Tool Co., Ltd., Brighton; Ronald G. Senior, Steel-Craft Jig & Tool Co., Ltd., London; Fred A. Evans, Press Equipment, Ltd., Birmingham; and Dick W. Giffords, also of Talbot Tool.

Greater New York Has Hard Surfacing Talk

Tiarco Corp.'s Paul J. Topelian explained two new hard-surfacing developments to Greater New York members at their October meeting. "Hardalume," a new technique in hard-surfacing aluminum with a layer of chromium without the conventional intermediate coatings of foreign material, produces an unusual degree of ductility over a wide temperature range. Samples of material plated by this process had been intentionally deformed in the laboratory without chipping or failure of the bond, and were available for inspection.

One successful application of the technique was made by a computer company. It was able to cut the cost of a small imprint roll from $160, when made from stainless steel, to $40 for a "Hardalume" roll. The number of impressions possible was raised from eight to eighteen thousand.

"Kromolloy," a process for hard-surfacing industrial files and rasps, was discussed by Mr. Topelian. These tools average 35% more wear than conventional files. *—Fred W. Bechtold*

Bellows Equipment Is Topic at Wichita

Fifty members of Wichita chapter were present at the October 10 meeting to hear J. J. Mudd, sales manager of The Bellows Co., give a short talk on "Air-Powered Applications for Machine Tools by the Use of Bellows Equipment. Following the talk a film entitled "Operation Push Button" was shown. *—James L. Hill*

TRI-CITIES—Don Johnson, personnel director of Mid-West Mfg. Co., answers questions on forming procedure for the 185 touring the plant in October. A subsidiary of Admiral Corp., the 1,000,000 sq. ft. structure houses 1900 employees. *—Don Shewry*

TOLEDO HONORS RAY PETERSON FOR HIS OUTSTANDING CONTRIBUTIONS AND SERVICES

Sixteen past chairmen of the Toledo chapter were on hand October 10 at the Elks Club to help celebrate "Ray Peterson and Past Chairmen's Night." Mr. Peterson was honored for his many services to ASTE on both the national and local level, and was publicly thanked for his devotion to his chapter by Phil Wood, new Toledo chairman, who presented him with a scroll from the ASTE National Office.

A special business meeting was called to fill the vacancy created by the recent resignation of Chairman Lewis Pascoe, and the subsequent elevation of Phil Wood to that office. The chapter unanimously elected Lawrence Rothert to fill Mr. Wood's post as first vice chairman. William Moreland, national secretary of ASTE, installed the newly elected officers.

Special guests who were honored at the meeting were Peter Peterson, father of Ray Peterson; Les Bellamy, past president of ASTE; Owen Harry, member of the National Standards Committee; and Gustave Weber, pastor of Glenwood Lutheran Church of Toledo.

Speaker for the evening was Lou Klewer, outdoors editor of the *Toledo Blade*, whose speech, "The Uttermost Part of the Earth," accompanied by movies of his twenty-day fishing trip in Del Fuego, gave a glowing description of his venture into the Argentine. Food and lodging during his stay amounted to but twenty-two dollars, Mr. Klewer related, and his pictures proved the ordinary landing net inadequate for the trout in neighboring streams.

—Robert S. Bollin

TOLEDO—Ray Peterson thanks the chapter for its gift of a complete fishing tackle outfit with which to better enjoy his spare time.

Cutting Tool Progress Heard by Muskegon Members

The October 9 technical session of Muskegon chapter was devoted to a talk by H. M. Schrier, Metallurgical Products Department of General Electric Corp., whose speech dealt with the progress being made by tool and machine industries in increasing the life of cutting tools. He supplemented his talk with slides showing comparison charts of carboloy and ceramic tools at work. The Carboloy machinability computer was also demonstrated.

J. M. Holt, Jr., associate books editor from national headquarters, was guest for the evening. *—Jack Jilek*

PHILADELPHIA—"Automation—Is it for You, Your Product, and Your Company?" was the title of a talk by E. H. Flook, of the National Automatic Tool Company, center above, at the Sept. 20 meeting. The point made was that automation is here now, growing fast, and to a varying extent, its application can probably improve some part of any company's production procedure. Pictured from left are: Mr. Brogan of NATCO; W. Lees, chapter vice chairman; Mr. Flook; Mr. Keates, also of NATCO; and C. C. Brogan, Jr., program chairman. *—John Chernokreluk*

First Kingston Night Celebrated by Mid-Hudson

October 9 saw the inauguration of a regular annual event in the Mid-Hudson program. "Kingston Night" was keynoted by the welcoming speech of Kingston's Mayor Fred H. Stang, followed by the coffee speaker, Robert M. Peebles, manager of the local radio station WKNY. With 24 years of radio work behind him, Mr. Peebles was able to point out the growing trends in broadcasting, such as localization of news coverage, supplanting the nationwide newscast of a decade ago. He supported the view that television has not replaced radio, but rather, has localized it, and that both can exist side by side and each fill a public need.

Speaker for the technical session was H. E. Linsley, associate editor of the *American Machinist* magazine. His subject was an analysis of how present-day prosperity was brought about by machine tools, and touched on the attitude of public resistance to machinery when it first appeared in England. He likened this to the current public apprehension of the replacement of human workers by automation. This, he pointed out, would diminish, as people realized that only tedious and strenuous labor would be replaced. *—Attila De Illy*

SCHENECTADY — Thomas Leavenworth, left, of the John E. Larrabee Co., accepts an affiliate member plaque for his company from Chapter Treasurer George S. Nelson, supervisor of G.E.'s research lab and host for the October plant tour of General Electric.

Dayton Hears Solution To Circuit Breaker Problem

Harold Jenkins explained "The Capabilities and Potential of Cypak Control" at the October 8 technical session of Dayton chapter. Mr. Jenkins, who is district control engineer for Westinghouse Electric Corp., covered his company's solution to the circuit breaker or relay breakdown problem by using electrical impulses, thus eliminating all moving parts. Although the ultimate life of the item is still unknown, it is even now longer by far than that using any other method. *—Bob Bleicher*

Central Pennsylvania Proposes New Chapter

The purpose of the October 8 meeting of the Central Pennsylvania chapter was to discuss the formation of a new ASTE chapter in the Cumberland Valley. Representatives from most of the plants in the area under discussion were present, and from them an organizing committee was chosen, consisting of a chairman, Paul Blubaugh, vice president of the Vulcan Machine Co.; and a vice chairman, Merle Barnhart, process engineer with Fairchild Aircraft Div. These men will meet with a committee from Central Pennsylvania to discuss progress.

Three talks were given during the course of the evening, to familiarize those present with ASTE background. John L. Webster, factory manager of Teterboro's Bendix Aviation Corp. plant, discussed the society in general. David A. Schrom, superintendent of Borg Warner Corp., York Div., had as his topic, "ASTE and You," while Marvin Bunting, ASTE staff administrator, reviewed the requirements for a new chapter. *—Paul F. Leese*

Rochester Hears NAM speaker

Rochester chapter's guest speaker for their October 1 meeting was Maxwell E. Hannum, education director of the National Association of Manufacturers.

One hundred twenty five members with thirty guests from Monroe County High Schools and colleges, together with executives from industry, heard Mr. Hannum's message, "Joint Needs and Problems of Education and Industry."

Mr. Hannum spoke highly of ASTE's work in scholarship awards and research serving both education and industry.

Rochester also held its annual clambake under the entertainment chairmanship of J. Windheim.

FAIRFIELD'S EXPERIMENTAL LYCOMING NIGHT SETS RECORD ATTENDANCE OF 230

FAIRFIELD—"Lycoming Night" guests conversing at the record-breaking meeting are, from left: J. D. Allen, D. F. Turner, Past President A. H. d'Arcambal, Speaker J. J. Jaeger, and Chapter Chairman E. W. Laistner.

Suzanne Olson Named Assistant News Editor

John W. Greve, editor of THE TOOL ENGINEER, has named Suzanne Olson assistant news editor of the magazine's staff. The position was formerly held by Janet Lofting who was recently promoted to news editor.

Mrs. Olson graduated from Purdue University's school of science. While on campus, she worked on the daily *Exponent*, becoming feature editor in her Junior year. She handled publicity campaigns for the Red Cross, Community Chest, and other organizations both in West Lafayette, Ind., and later in Cleveland, Ohio. Since her graduation she has contributed articles to local papers on a free-lance basis.

Mrs. Olson will cover ASTE activities on both national and chapter level.

Fairfield chapter chairman Gene Laistner's new idea in program planning produced "Lycoming Night" and a new attendance record of 230. This success was due to the efforts of Dick Prentice and Frank Dubuque.

For the technical part of the program, J. J. Jaeger, vice president and chief engineer of Pratt & Whitney, spoke on "Automatic Control of Machine Tools," and described the latest developments in the punch cord and tape system of controls. He pointed out that the table of a jig borer can be positioned more accurately with an automatic electronic system than by a skilled operator. However, he emphasized that, although in existence now at Pratt & Whitney, the system has not yet reached the point of practical application in industry.

Specially invited guests at the meeting were Past President A. H. d'Arcambal, retired president of Pratt & Whitney; J. D. Allen, machine tool sales manager of Pratt & Whitney; and from Avco's Lycoming Div., D. F. Turner, vice president and works manager; D. Armantrout, labor relations vice president; and C. Mason, controller. Leo Williamson, Lycoming of Williamsport's public relations manager, acted as toastmaster. Frank Dubuque presented Cornelius J. Bogert with an award as Lycoming's employee with the longest ASTE membership.

—Russell E. Drescher

PETERBOROUGH—Harry Conn, chief engineer of Scully-Jones & Co., talked on the economics of tool engineering at the chapter's October 4 industry and education night. From the left are: J. Olaveson, vice chairman; B. MacKenzie, delegate; the speaker, Mr. Conn; R. Naish, 1st vice chairman; W. Holt, editorial chairman; and W. Warren, program chairman. *—William Holt*

Obituaries

Von Roy Daugherty, National Education Committee, associate professor at Purdue University.

George W. Jackman, New Haven chapter, tool engineer at Waterbury Farrell Foundry & Machine Co.

Western Chapters Hear Ultrasonic Machining Program

September, October and November saw Raytheon Mfg. Co.'s program on ultrasonic machining presented at 14 western chapters. Personnel presenting the Waltham, Mass. company's programs were Burton B. Stuart of industrial products; Ralph M. Moschella of sonic products; J. L. Lovett, Los Angeles district manager; and Curt Little, field application engineer.

Long Beach heard the program in September, while October presentations were made at the San Fernando, San Gabriel, Los Angeles, Santa Clara, Golden Gate, Portland, Oregon, and Seattle chapters. November brought the tour to chapters in Phoenix, Tucson, Los Alamos, Denver, and Salt Lake City.

EVANSVILLE—Henry Day, left, coffee speaker at the Oct. 8 meeting, talked on "Getting the Most Out of Life." M. K. Bryant, right, division manager of Aro Tool Co., discussed pneumatic tools and demonstrated some of the other tools in his line. *—Gerald Lykken*

SOUTH BEND—The traveling exhibit of the evolution of measurement was displayed for the first time, accompanying a talk by C. G. Schelly, managing director of the Wilke Foundation, on the "Story of Measurement." Members here inspect the many historical standards of measure, instruments and models, among which is a replica of the ancient Egyptian master cubit and the first U.S.-made gage blocks.
—Harold I. Housewerth

SPRINGFIELD, MASS.—In "Facts about Gages and Gaging" Glenn H. Stimson, chief engineer of Greenfield Tap & Die Corp., explained latest developments in checking thread gages. James A. Ballow, right, is shown with Mr. Stimson at the October meeting.
—Allen M. Johnson

Racine Hears Investment Casting Talk

The October meeting of Racine chapter was devoted to the subject of investment castings, tracing its history from ancient times through the centuries until modern production designs came to require the present precision industrial processes in the foundry field. Robert C. Clark, president of Northern Precision Co., Inc., spoke on "New Dimensions for Designers through Precision Investment Castings."

Scholarship committee chairman Howard Heigl presented a check to scholarship award winner Ronald Hart, who talked briefly on his courses and progress at the Milwaukee School of Engineering.

—Alvin J. Michna

Varied Programs Highlight Recent Chapter Activities

"The Development of Milling" was the subject for **Akron** chapter's October 23 meeting. Presenting the talk were: Edward F. O'Brien and Herbert A. Loy, representatives of the Ingersoll Milling Machine Co.

Hunter Hughes of St. Joseph and Jack Knuth of the Ellinee Players shared the speaking honors at **Benton Harbor's** ladies night meeting.

The October 3 meeting of the **Binghamton** chapter was keynoted with a talk by J. A. Psenka of the National Broach & Machine Co. on the manufacture of broaches, their types and uses, and the problems they involve.

E. C. Benzing, Jr., Chicago district manager of The Bellows Co., presented an interesting talk and movie to **Fond du Lac** chapter on lower cost production with controlled air-power. Henry Faith gave a slide-illustrated talk on ASTE's Twelve-Month Plan.

Hendrick Hudson chapter's ladies night speaker was Father Kuhn of Sienna College.

Indianapolis members learned more about automation at their October meeting. E. W. Denison of G.E. spoke on "A Practical Approach to Automation."

Harry Conn of Scully-Jones & Co. presented a talk on "Economics of Tooling and Manufacturing" at **Kokomo** chapter's October meeting. He pointed out how sales, engineering and production are interrelated, and how efficient coordination is required for an enterprise to return a profit.

J. J. Thornton, technical engineer of the Fellows Gear Shaper Co. addressed **Louisville** chapter on the theory, function, and design principles of gears.

A tour of the Nashua Corp. was on **Merrimack Valley's** agenda for October. Preceding the tour, George F. Gordon, chief engineer of this paper finishing company, outlined the plant's activities.

High-speed turning of steel with a carbide tool was discussed by David Smith of Jones & Lamson Machine Co. at **Monmouth** chapter's October 9 meeting. Mr. Smith described the relatively high power requirements necessary to obtain the most economical production of mild steel parts with carbide-tipped tools.

New Haven chapter met October 11 to hear R. F. Spillett of Crucible Steel Research Div. discuss new developments in tool steel.

Speaker at **Northwestern Pennsylvania's** October 4 meeting was D. E. Walcutt of the National Machine Co., who showed a movie illustrating the

Chapter Activities

(Continued from previous page)

forging of bolts and nuts through the use of automatic equipment manufactured by his company.

Tooling with plastics was discussed by A. Juras of Federal Machinery Sales Co. at **Peoria's** chapter meeting.

R. P. Stemler of Vanadium Pacific Steel Co. spoke at **Phoenix** and **Salt Lake City** chapter meetings on the metallurgical aspects of subzero treatment for tool steels.

"Application and Design of End Mills" by Brown & Sharpe Mfg. Co. was the topic of **San Diego chapter's** meeting. Also on the program was a movie entitled "God's Country," courtesy of the Johnson Motor Co.

At **Southeast Kansas** chapter's first official meeting Harold J. Bales spoke on the subject of chapter and company growth.

St. Louis chapter observed an exhibition set up by St. Louis suppliers of models and literature devoted to tool engineering.

Following a talk by Col. David Gould, **Twin Cities** chapter toured the Air Force Base at Fort Snelling. It proved to be of particular interest to those ASTE members working in the field of electronics. In September, the chapter had held its annual dinner dance.

Sweden Studies Automation

Arne Henrikson, business economist of the Confederation of Swedish Trade Unions, and Sven H. Asbrink, director of the productivity center of Swedish industry, visited ASTE headquarters recently to get the Society's viewpoint on how to accelerate applications of automation in Sweden.

They have returned to Sweden, after having conducted a comprehensive survey in this country.

Russian Automation Disclosed at Chicago

Two hundred seventy-five members and guests of Chicago chapter turned out to hear Nevin L. Bean speak about his recent trip to Russia. Mr. Bean, who is technical assistant to the general manager of Automatic Transmission Division, Ford Motor Co., disclosed that automation was in full swing at the ball-bearing plant, and told of visiting other plants, including those of the automotive industry. He brought pictures of these plants in operation and the various equipment used in Russia.

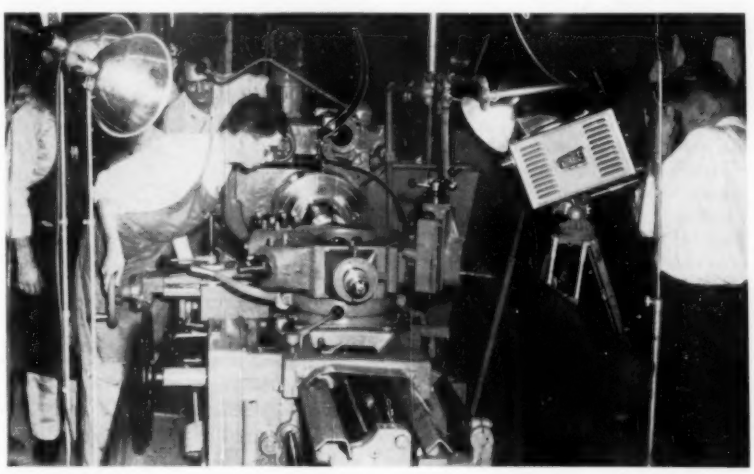
—L. B. Klemme

ROCHESTER—Robert Berl of Penfield, N. Y., left, receives the chapter's Tool Engineer Scholarship Award of 1,000 from Vice Chairman Clifford Sears. This award will enable him to study at the Rochester Institute of Technology for three years. *—Floyd Weed*

Lehigh Valley Sees Ceramic Cutting Tool

James Edge, director of research and development of the Sintox Corp. of America, explained to Lehigh Valley chapter the advantages and economies inherent in Sintox ceramic cutting tools, at their September 21 meeting. He pointed out that such tools can be used on present day equipment to machine many materials which are hard to machine. Better finishes can be produced because of the ceramic's low thermal conductivity, its nonaffinity for metal build-up, and its high resistance to abrasion. Economies are effected, not only because of the ready availability of the raw material used for the tools, but also because of the amount of metal removed per unit. A trip to Sintox's Allentown plant followed, where a demonstration was given of the cutting power of Sintox tools.

—Bruce A. Schaller



WILLIAMSPORT—The demonstration of ceramic tooling given at the Williamsport Technical Institute on October 8, was televised by closed-circuit television to insure a clear view to everyone present, including students of the technical institute. Above is the lathe demonstration in progress, with the TV camera to the right of the lathe. Speaker R. C. Mulligan, sales representative and applications engineer of D. A. Dobbins, pointed out that most lathes are not powerful enough for ceramic tooling work. *—Forrest Johnson*

Production Know-How Discussed at Tucson

The El Rio Country Club was the scene of the September 11 technical meeting of the Tucson chapter. Speaker for the evening was Harry Conn, chief engineer of Scully-Jones and Co., who talked on "Production Tooling Problems." He emphasized the technical understanding necessary for successful trouble shooting, and pointed out the need for realizing the problem's many aspects, including the human element. Slides illustrated the discussion.

—C. J. Doubek

LITTLE RHODY—Kenneth L. Bates, left, field engineer of Norton Co.'s northeast district, gave a comprehensive talk on the grinding of cemented carbides Oct. 4. At right is Paul Watelet, chapter chairman. Also discussed was the 12-Month Plan. *—Richard Kilbane*

WORCESTER—Metting jointly with the Worcester chapter of the Society of Carbide Engineers Oct. 2, members of both groups pose for this picture. In front are R. Crontrucci, treasurer, SCE; P. Garlock, chairman, SCE; the speaker, H. J. Siekmann, of G. E.'s Carboloy Dept., Detroit; Dr. L. P. Tarasov, chapter chairman. Behind are A. Kosciusko, chapter WES councillor; J. R. Baker, SCE vice chairman; chapter officers J. C. Lalor, vice chairman; D. W. Hoyt, secretary; and A. S. Hamilton, treasurer. Mr. Siekmann talked on cemented cutting tool applications, and demonstrated the Carboloy machinability computer at the meeting. *—Leon F. Miller*

Measurement Accuracy Is Houston Topic

Charles F. Lewis, metallurgical engineer of the Cook Heat Treating Co., spoke to Houston chapter on accuracy of measurement. He used his knowledge of statistical control and mathematical computations to show how accuracy of measurement has been developed over the years. It was pointed out that new methods of measurements must be found capable of producing a more accurate international standard.

Houston chapter's first fall meeting was held at Baker's Oil Tool Co., manufacturer of a line of oil field specialties and tools and equipment for cementing casing in oil wells.

Mark Johanning, chapter membership chairman, spoke at the September executive meeting. *—W. H. Reifschneider*

Monadnock Plans Scholarship Loan Fund

At the October 18 meeting, Monadnock's Chairman Richard Swahnberg announced the availability of an interest-free scholarship loan fund amounting to $250 a year for two years, to be awarded qualified high school seniors in the Monadnock region. Qualifications include entering a two-year technical institute to study drafting or mechanical arts; the ultimate desire to enter the tool engineering field; financial need; and scholastic ability, extra-curricular activities, leadership qualities.

Atomic energy as a source of power was the subject of the evening's speaker, John M. Detwyler, nuclear engineer of General Electric Corp. He described several types of atomic reactors and their uses, and labeled atomic energy a good investment in a future marked by increased power needs and fewer natural resources. *—David A. Piper*

NORTH TEXAS—The smiling group pictured behind Membership Committee Chairman Mark Johanning, front left, and Director Irving H. Buck, right, are new chapter members sponsored by their employer, Collins Radio Co., rather than the membership committee, as previously reported.

Boston Celebrates Father and Son Night

Fifty-eight sons and one daughter turned out to hear Dr. Thomas O. Paine's talk, "The Atom Goes to Sea," at Boston's father and son night October 4. Dr. Paine discussed the atom, not only as an instrument of war but, more important, as a tremendous source of peacetime power. He outlined the seemingly unsolvable problems in submarine nuclear propulsion research, and described the technical "know-how" necessary to build an atomic power plant. A film took the audience through the Atomic Energy Commission's West Milton site, where the first commercially distributed atomic electricity for home and factory consumption was produced, and also depicted geological and technical methods used to locate, mine and process uranium.

Following the technical session, Richard Tonis of Brockton, a former Marine corpsman and lieutenant of the Massachusetts State Police, presented an interesting performance of skill with pistols, keynoting safety. *—M. P. Burns*

Philadelphia Topic Is High-Speed Machining

One hundred fifty of Philadelphia chapter's members and guests heard a panel discussion on high-velocity machining with metallic and nonmetallic materials October 18. Panel speakers were W. L. Kennicott of Kennametal; R. Jablonski of General Electric; and A. B. Albrecht of Monarch Machine Co.; with Past Chairman E. Hollingsworth of Tools Inc. moderating.

Mr. Kennicott's subject was the evolution of carbide cutting, touching on the problems it created, such as the strains caused by brazing of the carbide, heat checks from grinding, and thermal expansion of both the carbide and the tool steel holder. Through laboratory experiment the currently used throw-away carbide tip was developed, eliminating grinding time, and being inexpensive enough to be scrapped after use.

Mr. Jablonski discussed the advantages and disadvantages of ceramics and cemented oxides for high-speed removal of metal. Although chipping and breakage of these tools is a drawback in their use, proper bonding can control these, and the increased steel-cutting speeds attained, plus the ease of grinding the ceramics, offsets this.

Mr. Albrecht touched on the conditions necessary for optimum performance in high-speed machining, whether using carbides or ceramics. He discussed rigidity, horsepower, lack of vibration, high cutting speed, automatic controls, and simplicity of operation. He added that throw-away tools have been found most efficient, and are recommended by machine tool builders.

—John Chernokreluk

GRANITE STATE—Howard Smith, chapter member from Eliot, Maine, recuperating from a case of polio contracted in 1955, is shown here with his family. Leatherwork therapy has occupied him until he can return to his former job as toolroom grinder for G. E. *—Norman Fine*

Milwaukee Visits Many Departments of Plant

One hundred ninety-two members and guests of Milwaukee chapter participated in a plant tour of the A. O. Smith Corporation on October 11. Preceding the tour, William Lamm from the company's public relations department briefly reviewed its history and present products. Guides were provided by the plant to take groups of 30 members by bus to the various departments of the plant, including those concerned with the manufacture of pipe, pressure vessels and automobile frames. In the Science Building, samples of A. O. Smith products were on display.

Milwaukee Chapter Chairman Ralph Lund presented scholarships to this year's winners: Wilbur Whiteside, who is planning to attend Ripon College and complete the last two years at MIT in engineering; and Gordon J. Lis, who is attending Marquette University and working for a degree in mechanical engineering. *—Walter Behrend*

SYRACUSE—Speaker Edward J. Ball, left, is discussing the Oct. 9 program with Chapter Chairman Vic Fitting, Program Chairman Andrew Lachner, and Vice Chairman Paul Hansel. Mr. Ball, gear analysis engineer, National Broach & Machine Co., talked on gear manufacture by the shaving method. *—Paul H. Hansel*

London-St. Thomas Tours Local Plant

The Ex-Cell-O Corp. of Canada, Ltd., provided a tour of its London plant for the October 19 meeting of London-St. Thomas and District. After the general manager John Gilchrist welcomed members and guests to the plant, Art Schlutz of Detroit, Ex-Cell-O's publicity manager, presented slides and records showing the expansion of the company and its line of products, in ratio to the growth of the business and industrial world. *—Richard J. Merriott*

ERIE—Speaker Leonard Swanson, right, president of Swanson Tool and Machine Products, Inc., chats with Chapter Chairman David B. Schuler following his Oct. 2 talk, "Economic Considerations of Automation," Mr. Swanson cited his firsthand observations of European production methods. *—Leo B. Weiner*

CALUMET AREA—Deep die operation errors and their correction was the subject of a slide-illustrated talk by Stanley Cope, president, Acme School of Die Design Engineering at the October 8 meeting. Mr. Cope, above left, is shaking hands with chapter public relations chairman Michael Kulan, while John Marshall of Inland Steel Co. looks on.

San Fernando Member Tours Europe

Matthew Margulies, a member of San Fernando chapter, and director of the California Institute of Tool Engineering, is making an extended tour of Europe. He will study the effect of tooling in aiding the rapid recovery and industrial growth of European countries.

Mr. Margulies will attend the International Auto Show being held in London at "Earl's Court," and while on the continent he will visit the Citroen works in France and the Mercedes Benz plant in Germany. His itinerary will take him to Turin, Italy for a trip through the custom auto works, then to Israel for a tour of the industrial center of Tel Aviv.

Air Gaging Topic At Hamilton District

Members of Hamilton District chapter heard a review of air gaging for quality control at their October 12 meeting in the Fischer Hotel. The speaker was Frank Meyer, Jr., chief engineer of the instrument gage department of Taft-Peirce Mfg. Co., Woonsocket, R. I. Slides illustrated his talk, showing principles and applications of air gaging in respect to production and inspection problems. Its history was traced from World War II when a quality control method was needed for production lines manned mainly by unskilled help. Robert Read, of Taft-Peirce's Rochester office, assisted Mr. Meyer.

—Russ Wilson

Tooling Problems Outlined at Twin States

The October 10 technical session brought to Twin States members Harry Conn, chief engineer of Scully-Jones and Co., talking on the designing of adequate tooling for automation. He illustrated with slides how certain tool ing problems are being solved, emphasizing presetting and quick-changing of tooling.

George Julien, education committee chairman, reported on the progress being made in organizing a curriculum and choosing a faculty for the proposed school, currently in the planning stage, sponsored jointly by ASTE and local manufacturers. *—V. W. Erickson*

Coming Meetings

National

ASTE 25th Annual Meeting and Silver Anniversary will be held March 23 through 28 at the Shamrock Hilton Hotel, Houston, Tex.

NATIONAL PROGRESS COMMITTEE—

Dec. 1, at National Headquarters, Detroit, Mich.

NATIONAL STANDARDS COMMITTEE—

Dec. 7-8, at the Palmer House in Chicago.

NATIONAL OFFICERS MEETING—

Dec. 8, at National Headquarters, Detroit, Mich.

Conference

ILLINOIS INSTITUTE OF TECHNOLOGY—

Dec. 6-7, Chicago, "Cost Control."

Chapter

AKRON—Dec. 8. Firestone Country Club. Annual Christmas dinner dance.

ANN ARBOR AREA—Dec. 8, Union Hall, Tecumseh. Dinner dance, featuring ham and shrimp cocktail. Strictly fun.

ATLANTA—Dec. 10, 7 p.m., Cherokee Restaurant. "Ceramic Tooling" by the Stupakoff Div. of The Carborundum Co.

BALTIMORE—Dec. 5, 7 p.m., Engineers Club. Ladies Night. J. Donald Pistula, of Corning Glass Works, speaking on glass making.

BUFFALO-NIAGARA FRONTIER — Dec. 1, Lockport's Park Hotel. Christmas party.

CLEVELAND—Dec. 15, 6 p.m., Hotel Statler. Christmas party—dinner and entertainment. Scholarship award.

COLUMBUS—Dec. 14, 6:30 p.m., the Whitehouse. Traditional December stag party, entertainment.

DETROIT—Regular Section, Dec. 13, Christmas party. Carbide Section, Dec. 7, "Ceramic Tooling."

ELMIRA—Dec. 3. Ladies Night. Henry Ziel of the Eclipse Machine Co. will speak.

EVANSVILLE—Dec. 10, 6:30 p.m. Hadi Temple. Ladies Night.

FOX RIVER VALLEY—Dec. 7, 6:30 p.m., Baker Hotel, St. Charles. Ladies Night and annual Christmas party.

HAMILTON DISTRICT—Dec. 14, 6:30 p.m., Fischer's Hotel. L. L. Mullen, field information officer of the Hydro-Electric Power Commission, Ontario, speaking on "The St. Lawrence Power Project." Past Chairmen's Night.

HENDRICK HUDSON—Dec. 19, 6:30 p.m., Hampton Manor, Rensselaer. "Press Work of Metals," presented by V & O Press Co. and Henry & Wright Co.

INDIANAPOLIS—Dec. 8. Social hour, 7-7:30 p.m., followed by annual Christmas dinner dance, featuring Ladies Night.

KANSAS CITY—Dec. 19, 7 p.m., George Hodes, Jr. of Prier Brass & Mfg. Co. will conduct a tour of the plant. Refreshments follow.

KEYSTONE—Dec. 17, 7 p.m., Castle Restaurant. Gene Chaudrak of Ernst and Ernst on "Relation of the Tool Engineer to Manufacturing Management.

KNOXVILLE-OAK RIDGE—Dec. 7, 9 p.m., Eagles Lodge, Oak Ridge. Christmas dance.

LANSING—Dec. 7, 6:30 p.m., Civic Center Dining Room. Ladies Night. R. Jameson, Jameson Machine & Tool Co., will show movies of Michigan.

LITTLE RHODY—Dec. 8, 7:30 p.m., Johnson's Hummocks. Annual Christmas dinner dance.

Also Don L. Davis, known as "Mr. Gadgets," president of the Gadget-of-the-Month Club, Inc., and a gadget authority.

LEHIGH VALLEY—Dec. 14, 7:30 p.m., Western Electric, Allentown plant.

LONDON-ST. THOMAS & DISTRICT—Dec. 14, 7 p.m., Town & Country Club, Stomas. "Stump the Experts" Night.

LONG BEACH—Dec. 12, 7:30 p.m., Petroleum Club. Paul J. Robinson of Brown & Sharpe Mfg. Co. will talk on "Milling Cutter Design and Application."

LONG ISLAND— Dec. 10, 8:30 p.m., Garden City Hotel. "Basic Considerations in Aluminum Forming," by E. V. Sharpnack of Reynolds Metals. Educators and industrialists invited.

LORAIN COUNTY—Dec. 5, 7 p.m., Brown-Lipe-Chapin Div. of G.M.'s Elyria plant for tour.

LOUISVILLE—Dec. 7, 8 p.m., Wildwood County Club. Dinner dance for Ladies Night. Members may bring one guest couple.

MADISON—Dec. 1, 7 p.m., Christmas Party.

MERRIMACK VALLEY—Dec. 6, 6:30 p.m., Pope Machine Co. tour. A Boston lawyer will speak on patents.

MID-HUDSON—Dec. 11, 7 p.m., Texaco Laboratories, Beacon, N.Y. A Texaco representative will speak.

MILWAUKEE—Dec. 13, 6:30 p.m., Serbian Hall. Film on development and use of oxide cutting tools. Barbershop quartet, community singing, carols.

MONADNOCK—Dec. 8, 7 p.m., American Legion Home in Keene. Ladies Night and annual dinner dance.

MONMOUTH—Dec. 11, 8 p.m., Joseph's Restaurant, Eatontown. "Fundamentals of Investment Castings," by Walter A. Dubovick, president of Engineered Precision Casting Co.

MUNCIE—Dec. 7, 6:30 p.m., Green Hills County Club. Christmas party and Ladies Night; entertainment.

MUSKEGON—Dec. 11, tour of the W. C. Warren Paper Co.

NEW HAVEN—Dec. 21, 6 p.m., New Haven Country Club. Ladies Night at the Christmas party.

NIAGARA DISTRICT—Dec. 6, 7 p.m., Rose Villa Inn, Welland. "Operation Push Button," a film from Bellows-Pneumatic Devices of Canada, Ltd.

OKLAHOMA CITY—Dec. 4, 7 p.m., Oklahoma City University. "The Workings of a Grinding Wheel," by R. O. Lake, vice president of the Macklin Co.

PETERBOROUGH—Dec. 6, 8 p.m., Empress Hotel, Kawartha Room. Cliff Farr of Standard Modern Tool Co., Ltd., on automation in Canada.

PHILADELPHIA—Dec. 13, 6 p.m., Penn-Sherwood Hotel. Christmas party.

PHOENIX—Dec. 10, Reynolds Aluminum. Dinner, plant tour, members only.

PORTLAND, ORE.—Dec. 7, 6:30 p.m., Amato's Supper Club. Annual dinner dance with entertainment.

ROCHESTER—Dec. 3. Joint meeting with Rochester chapter of NATDA. Panel discussion by L. E. Mingus, Carl Fuchs, M. Bader, H. Liebert, H. Gilbert, and C. Newton.

SAGINAW VALLEY— Dec. 8, Frankenmuth. Christmas party.

SAN FERNANDO VALLEY—Dec. 5, 7 p.m., Hody's Restaurant. R. N. Norton of the Norton Co. showing two films.

SAN GABRIEL VALLEY—Dec. 6, 8:30 p.m., Rainbow Angling Club, Azusa. A Consolidated Electrodynamics Corp. representative will give "Machine Tools and Vibration." Also color film, "Dynamic Measurements."

SCHENECTADY—Dec. 4, 7:15 p.m. A plant tour of Albany Packing Co., with luncheon following. Wives invited.

SCHUYLKILL VALLEY—Dec. 11, 8 p.m., The Wyomissing Club, Reading. J. P. Guyer, Jr., district manager of S. C. Johnson & Son, Inc. will give "Application of Wax Products to Industry," with a sound color film. Dinner at 6:30.

SPRINGFIELD, MASS.—Dec. 18, Springfield Armory. From 5:30 to 6:30 the armory museum will be open. Smorgasbord supper at 6:30. Meeting at 8 p.m. Otto Von Lossnitzer, heavy weapons expert, on "Modern Aircraft Weapons."

TOLEDO—Dec. 12, 6:30 p.m., Maumee River Yacht Club. Lynn A. Williams, president of Anocut Engineering Co., Chicago, talking on electrolytic grinding.

TWIN STATES—Dec. 12, 7 p.m., Adna Brown Hotel. "Ultrasonic Impact Grinding" by Ralph Moschella of the Raytheon Mfg. Co.

WORCESTER—Dec. 3, 6 p.m., Putnam & Thurston's Restaurant. Christmas party and Ladies Night.

Positions Available

MANUFACTURERS REPRESENTATIVE—Chemical Coolant Manufacturer now selling on a national basis is changing sales program to utilize services of manufacturers representative. Territories open: Ohio, Western Pennsylvania, Upper New York State and portion of New England. Write to: Box 091, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

TEACHING POSITION—Assistant or Associate Professor in Industrial Engineering. Need experienced man from diversified industries in production planning and control, tooling and mechanization, and other production areas. Research facilities in these areas, cooperative industries assist. Advanced degrees helpful. Excellent consulting opportunities. Beautiful campus. Nine-month contract. Some teaching experience desirable; can develop new courses. Salary open. Write: Department of Industrial Engineering, Washington University, St. Louis 5, Missouri.

LAST CHANCE!

Gadgets contest closes December 31. See list of cash prizes and other details elsewhere in this issue.

appearing in this issue

1956 TECHNICAL INFORMATION INDEX

Society members often ask how they can get the most value out of the wealth of technical information and articles currently appearing in THE TOOL ENGINEER. The answer is near at hand: use the annual index appearing on page 271 of this issue. Beginning in 1953, the index has been included in the back pages of the December issue, covering all technical material published in the current year. The editorial staff has devoted much thought and effort to improving this handy reference tool with generous cross references, inclusion of subtopics and separate listing of authors of major articles. It is felt that the 1956 Annual Index is the best and most complete to date. Comments and suggestions regarding its use or improvement would be welcomed by the editors.

over 8,000 Different Cylinder SELECTIONS—

Miller

AIR AND HYDRAULIC

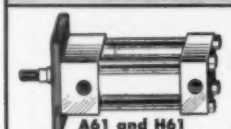
CYLINDERS AND BOOSTERS

"IN STOCK" for immediate delivery..

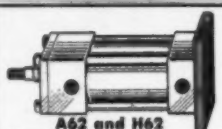
See Miller Bulletins A-105K(Air) and H-104K(Hydraulic) for Complete Dimensions and Engineering Data on these "in-stock" sizes and other Custom Miller Cylinders in bores up to 20" and strokes up to 22 feet.

"IN-STOCK" MODELS

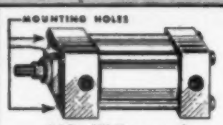
"A" Signifies Miller 200 psi Air Cylinders; "H", 2000 psi Hydraulic Cylinders. Interchangeable Mountings Are Shown In Red On Drawings.



A61 and H61
Flange Mounting on Rod End
(A61 not available in 8" bore)

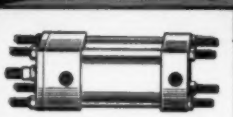


A62 and H62
Flange Mounting on Cap End
(A62 not available in 8" bore)

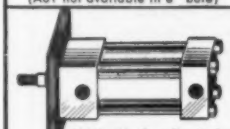


A63—8" Bore only
Flange Mounting on Rod End

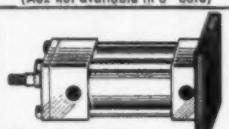
A64—8" Bore only
Flange Mounting on Cap End



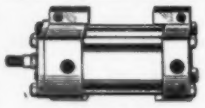
A50 & H50—Tie Rods not extended beyond nuts.
A51 & H51—Tie Rods extended both ends (shown).
A52 & H52—Tie Rods extended. Cap End only.
A53 & H53—Tie Rods Extended. Rod End only.
A54 & H54—Two Tie Rods extended at both ends.



H65—Hydraulic Only
Flange Mounting on Rod End

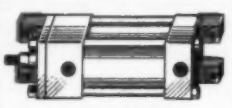


H66—Hydraulic Only
Flange Mounting on Cap End

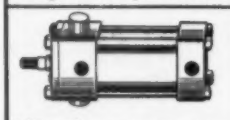


A72 and H72
Side Lug Mounting

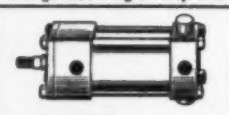
A74 and H74
Side Flush Mounting



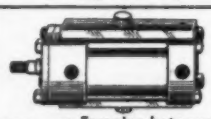
A77 and H77
Side or Foot Mounting



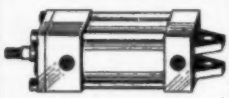
A81 and H81 Trunnion Mounting on Rod End



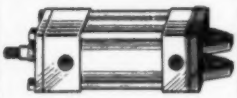
A82 and H82 Trunnion Mounting on Cap End



A83 and H83 Trunnion between Head and Cap
(one week delivery)



A84 and H84
Pivot Mounting



A86 and H86
Pivot Mounting

IN STOCK BORES In Inches

"IN-STOCK" STROKES (In Inches)

	BORES	ROD DIA.	ROD TURN DOWN & THREADS		1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
AIR	1½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12									
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12									
	2	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	2½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	3¼	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	4	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	5	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	6	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	8	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
HYDRAULIC	1½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12									
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12									
	2	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	2½	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	3¼	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	4	1¾"	1¼-12	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	5	2"	1½-12	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36

(4) (3)

(1) "A" and "H" Models 82, 84 and 86 with strokes over 18" require stop tubes.

Column strength requires larger diameter piston rods for the following:

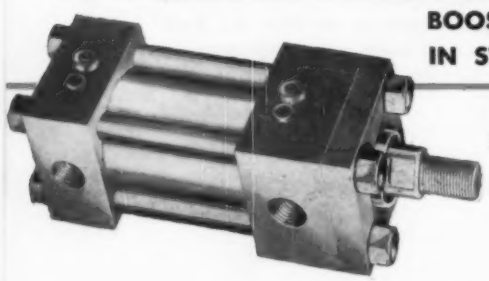
Air Cylinder Models A82, 84, and 86 with strokes inside area (1), when operated at 100 psi and over;

All hydraulic models with strokes inside area (2) and Models H82, 84, and 86 with strokes in area (4), when operated at 2000 psi and over;

Models H82, 84 and 86 with strokes inside area (3), when operated at 1000 psi and over.

Depending upon Trunnion Pin location, "A" and "H" Models 83 with standard diameter piston rods can have longer strokes than Models 82, 84 and 86.

See Miller File #251 for oversize piston rod and stop tube requirements.



BOOSTERS IN STOCK

Immediate Delivery on the following Miller 25 to 1 Ratio Boosters (80 psi air input produces 2000 psi hydraulic oil output): Model B4, 5" bore, 1" dia. ram, 6" and 12" strokes; Reciprocating Booster Model DA77-RBAB, 5" bore, 1" dia. ram, 6" stroke. Also Booster Tanks, 3" dia., 6" and 10" heights.

Write For Catalog and Stock Price List

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FLICK-REEDY CORP.

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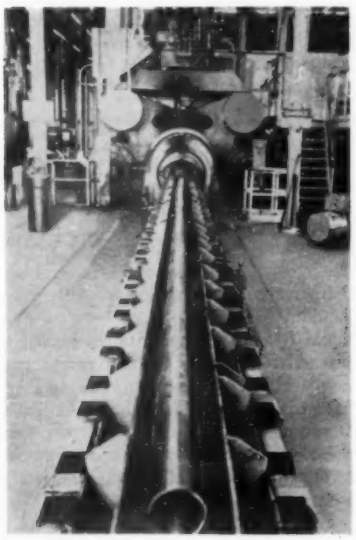
AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

PROGRESS IN PRODUCTION

MAMMOTH EXTRUSION PRESS SWINGS INTO PRODUCTION

Only press in the U. S. Air Force heavy press program for extrusion of steels and large titanium components has gone into operation at the Metals Processing Div. of Curtiss-Wright Corp. in Buffalo. Considered the largest of its type in the world, the giant horizontal unit has a squeezing power of 12,000 lb. The 126 ft long hydraulic press was designed, built and installed by Loewy-Hydropress Div. of Baldwin-Lima-Hamilton. To demonstrate speed and power of the press, in the illustration a 50 ft long tube 6 in. in diameter is extruded in 9 seconds.



NEW TECHNIQUES AND EQUIPMENT FOR COATED-ABRASIVE GRINDING AND FINISHING

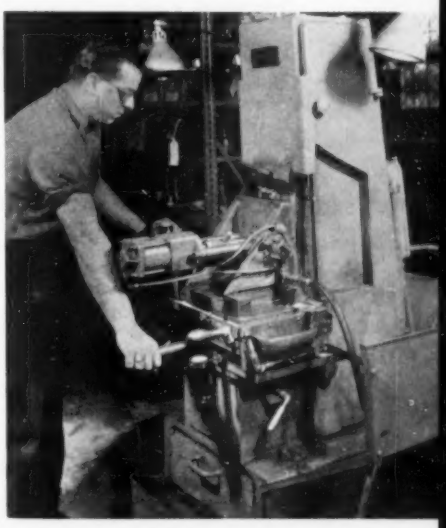
Production engineers brought sample parts and knotty problems with them to the Second National Metalfinishing Show. Held in the Cleveland clinic rooms of, and sponsored by, Behr-Manning, this show offered engineers an opportunity to look for solutions to finishing problems with the aid of over 100 machines made by 34 manufacturers.

Machines

Machines using coated-abrasives — belts, sleeves, disks and sheets—have achieved full production status. The industry is growing and new ideas are plentiful. For example, machines were exhibited that had multiple heads. With such machines, using different grades of belts, stock can be removed to result in correct dimensions and surfaces can be finished to the desired degree without intermediate handling. In several machines of this type, coated-abrasive belts are being used as work-feed conveyors.

In a large, two-head machine, the belt motors are electrically interconnected with an automatic belt tensioning device so the motors will stop if a belt breaks or runs loose. A flat-finishing machine can develop up to 90-psi pressure on the workpiece and remove up to 0.1 inch of stock per pass. Many multiple-head machines are being developed around rotary index tables.

A new lapping and polishing machine has been designed around a large circular coated-abrasive disk. Electromagnetic vibration causes the weighted workpiece to move around over the wet disk. Depending on the part material, cutting fluid, vibration level and disk characteristics, surface finishes of 2 microinches, rms, can be achieved. The



A single coated abrasive belt on this platen type grinder made by The Engelberg Huller Co. Inc., removed 1/32 in. from the flanges of 100 iron pump housings at the rate of one per minute. Operator is engaging the automatic infeed which carries work against the belt until a microstop is reached. A pneumatic oscillating attachment moves castings across the belt face.

Swing sander made by Bush Mfg. Co. permits the contact wheel to be raised or lowered, swung from side to side or moved forward and backward. Here it is shown being used to clean up tight radii in an automobile wheel.

same unit is used with a felt disk and various grades of finishing compounds for polishing.

Contact Wheels

Much development work is being done on contact wheels. Since the type of finish is partially determined by the action of the contact wheel, new types are being designed to satisfy production needs. Cloth-section contact wheels are used with coated-abrasive belts where buffing and gentle, rather than aggressive, cutting is required. Made of wavy sections that overlap, such wheels will not cause streaks on the finished work. Another contact wheel has a newly compounded rubber rim and a combination steel-and-aluminum wheel that improves performance but is much less expensive than previous wheels for similar jobs.

Some contact wheels are used with coated-abrasive sleeves rather than belts. These are used like grinding wheels but keep a constant diameter and avoid the waste of unused wheel centers. One new wheel has rubber fingers over which the sleeve slips. Centrifugal force tends to expand the fingers and holds the sleeve tight. In another design, rubber fingers are held in slots in the wheel. Again, centrifugal force keeps the sleeves tight. In this design, however, some fingers can be omitted to give a "softer"action. Also, the hardness of the fingers can be changed to meet varying conditions.

Techniques

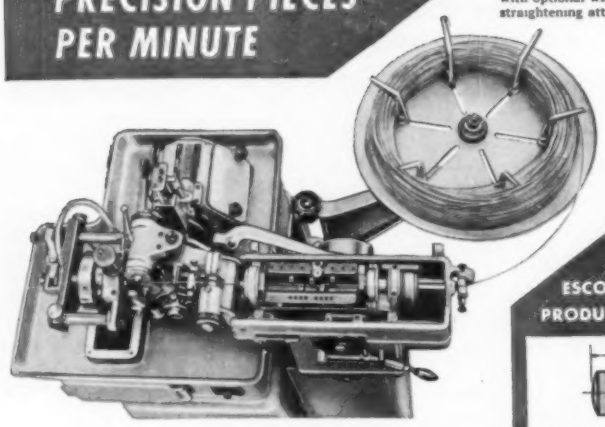
Coated-abrasive flaps, mounted around the periphery of a wheel, are finding wide use in the finishing of internal contours. In some designs, the abrasive flaps are backed up by brushes to change the cutting action.

Conservation of abrasive material, i.e., reduction of production costs, is especially apparent in the use of abrasive disks. Since only the outer 1 inch of a disk is worn when it is properly used, considerable value remains in the unworn part. It is now standard practice to cut a 9-inch disk down for use on a 7-inch wheel and then to cut it again for use on a 5-inch wheel. Equipment is now available for using what remains of the disk without backup. The disk can then be used down to the hub diameter. Equipment has also been designed to make use of scrap strips as mounted points for grinding small internal contours.

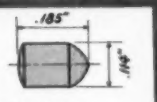
A technique has been developed for using belts to grind and polish internal radii without chance of the edge scoring the workpiece. Short, parallel, diagonal slits are made on both sides of a standard belt so that it will lap over itself and follow the contour of the work. Diagonals are made so that, if they were extended, they would form a V, the point of which would aim in the direction of belt travel.

GET UP TO 100 SMALL PRECISION PIECES PER MINUTE

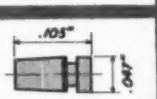
Below: ESCO ROTOMATIC DS 2 with optional wire-straightening attachment



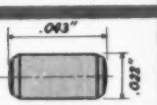
TYPICAL ESCO ROTOMATIC PRODUCTION RATES



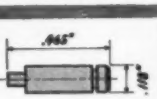
100/min.—brass



63/min.—nickel-silver



50/min.—nickel-silver



10/min.—mild steel

PARTS UP TO 5/32" DIA. X 2" LONG MACHINED AS CLOSE AS ± .00025" FROM COILS OR BARS

A Swiss automatic form-turning and cut-off machine with optional wire-straightening attachment—you get high-speed production from coils or bars of any length. Coil-feeding speeds and economizes your operation by eliminating bar ends and bar loading time. Machining is done by two cutting tools mounted in a cam controlled tool head. The tool head rotates around material which is fed, guided, and clamped by a collet and a guide bushing. Machined parts are smooth, straight and *entirely burr-free* when they are delivered to the tray *separate from the chips.*

Get more information today about this machine and see how it can boost your production and cut your costs.

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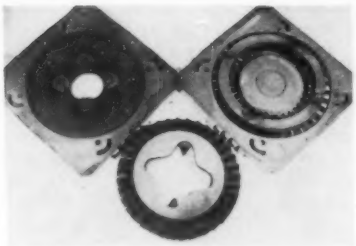
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-148

NEW CASTING PROCESS SOLVES PROBLEM

To cope with the problem of high temperature exhaust gases, Allegheny Ludlum Steel Corp. has developed a method called the Almold casting process to produce turbo-supercharger nozzle rings for use in diesel engines. The turbochargers are built by Alco Products, Inc. and installed on Alco diesel engines used in a variety of applications, including diesel-electric locomotives.

In the Almold process, type 321



The casting is a turbosupercharger nozzle ring for a V-12 diesel engine produced by fusing T-347 vanes into a T-410 hub casting. Above the casting is the shell mold and core assembly that holds the vanes in location for the casting operations.

stainless steel nozzle ring vanes are placed in a box cavity. The pieces are accurately positioned and then type 410 stainless steel is cast around the vanes.

Tolerance is 0.010. The outside diameter of the nozzle ring hub is cast to a finish size between 0.000 to plus 0.020 tolerance, with ⅛ in. to finish on the face.

The exhaust gases that beat upon the nozzle ring under operation on a diesel engine reach 1245 F for extended periods of time.

The process, which replaced the formerly used sand core casting, has resulted both in a saving of money and a higher quality nozzle ring.

OFFER SUGGESTIONS FOR WORKING STAINLESS

Eight reminders on how to fabricate stainless steel in the sheet metal shop have been outlined by Armco Steel Corp. According to the report, stainless steel fabricates readily to modern designs with tools normally used for other sheet metal work. However, these points should be kept in mind when working with this special metal:

1. Use more power—forming, shearing and other operations take more power with strong, tough stainless steel.

2. Adjust capacities—greater strength of stainless steel generally means reduced gage capacity for equipment. This can normally be figured as 4 or 5 gage numbers lighter than for galvanized or hot-rolled steel.

3. Keep contact parts smooth—dies, rollers, brake blades should be free frmo nicks and burrs. This helps keep metal surfaces attractive and unmarred.

4. Protect polished sheets—adhesive tape on tool contact areas, adhesive paper applied to the metal surface, pasted on newsprint or wrapping paper, will keep polished stainless unscratched and clean during fabrication and handling.

5. Keep blades sharp—for any shearing or cutting, use sharp, closely-adjusted, high quality blades.

6. Be cautious concerning heat build-up in welding—although general stainless welding procedures are like those for carbon steel, preventing heat build-up at the weld is more important. Properly sequenced welding operations, jigs or other means of drawing off heat should be used.

7. Wash off all soldering flux—immediately after soldering with plenty of clean water.

8. Use stainless steel fasteners—non-stainless fasteners can bleed rust.

SWITCHING DEVICE AIDS AUTOMATIC OPERATION

Automatic operation of low-power switching functions is furthered by the new static switching control system developed by General Electric's Industry and General Purpose Control departments. The system accomplishes operations ordinarily performed by contact-making devices such as relays.

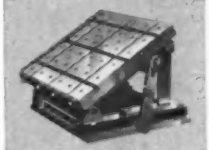
In the new system, a line of static components provides five logic functions basic to intelligence switching: "and," "or," "not," "memory," and "time delay." These units and their associated circuit components, such as power sup-

1ST

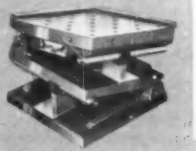
Your First Choice

FOR ANGULAR TOOLING . . . . ROBBINS!

"Magna-Sine" Magnetic Sine Plates for precision set-ups grinding single or compound angles.



Heavy Duty Sine Plates for angular machining. Wide variety of sizes. 12" square model shown.



Inspection Sine Plates for precision inspection and light machining on single or compound angles.

A look at the record shows exactly why Robbins equipment for angular tooling should be your first choice! Here's the record:

1ST to originate the idea of a simple sine plate for faster angular toolroom set-ups—*1936*

1ST to build these as a standard product for general distribution—*1936*

1ST to build a non-magnetic sine plate designed specifically for precision inspection —*1946*

1ST with a permanent magnet chuck—*1948*

1ST heavy duty sine plate for angular machining—*1954*

1ST *and the only one with* the exclusive "PERMA-FLAT" SWIVEL BLOCK—*1956*

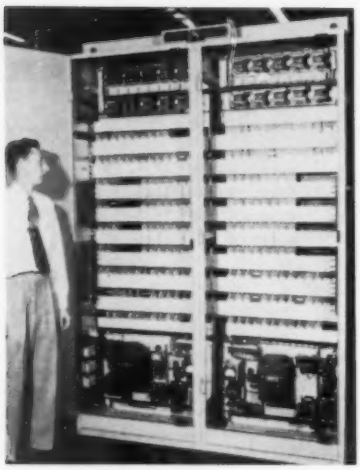
Robbins is the only sine plate manufacturer with a complete line of sine plates for every angular set-up problem in precision machining, grinding and inspection. We also offer complete engineering and manufacturing facilities for the solution of special problems, and are now building high-production automatic assembly and other special machines. Send for sine plate literature, or send us details of your requirements in special machinery.

OMER E. *Robbins* COMPANY

24800 PLYMOUTH ROAD DEPT. E DETROIT 39, MICH.

Also manufacturers of special machinery, automatic assembly machinery.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-149



The G-E static switching control is furnished here in completely engineered panel of the type used for complex control systems.

plies and output amplifiers, provide means of performing control applications for either whole processes or only individual machines.

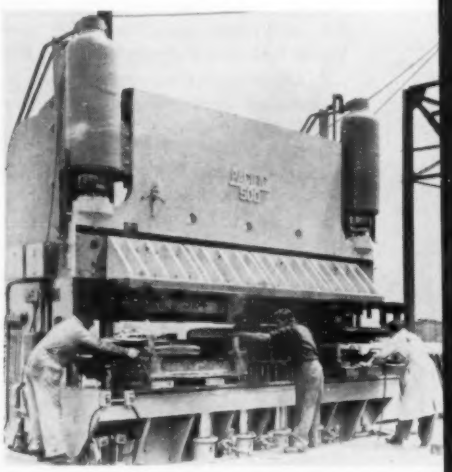
The devices are encapsulated and employ conservatively rated subcomponents. Absence of moving parts avoids the factors of wear, fatigue and other effects of environmental conditions which ordinarily contribute to failure. Fail-safe circuitry of the component assures maximum reliability. In addition, on return of power after any power stoppage, static switching control enables the circuit to resume operation at the same point in the cycle where it left off.

To simplify panel design, construction and maintenance, the new system includes plug-in construction, packaged power supplies, built-in wire trough and color coding. Monitor lights permit quick checks of proper circuit functioning.

Photo shows individual component designed for inclusion in simpler control systems.

PROGRESSIVE DIE FORMING WITH HYDRAULIC PRESS BRAKE

A finished refrigerator door is formed every 30 seconds on this hydraulic press brake at Kelvinator's plant in Mexico City. The press, made by Pacific Industrial Mfg. Co., draws, trims four sides and flange edges simultaneously. The entire bed area because the ram remains level and applies equal pressure throughout its length regardless of load distribution. Dies may be combination of blanking, stamping, deep drawing, embossing punching or forming.



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General-Purpose Sawing

with

High Speed

Accuracy, Economy

Model 4B/M2/E2
Equipped with standard work track
(Optional Equipment).

Let us prove to you the many reasons why this MARVEL Hack Saw offers the cheapest, most accurate and fastest "cut-off" method available to you at a low initial cost.

Ask your dealer, or write us for Bulletin GP35 which fully describes and illustrates the many exclusive features which makes this Hack Saw Machine your "best buy".

MARVEL No. 4B

***HIGH SPEED* HACK SAW**

Exclusive features

1. Horizontal Ball Bearing Saw Frame.
2. Screw Feed—Automatic or Hand Driven.
3. Quick Return Stroke—allows greater number of strokes per minute.
4. Simple Positive Coolant System.
5. Adjustable Stroke—can be shortened for larger capacity.
6. Speed Range—available in 1, 2 or 4 speed models for wider range of work.

MARVEL *Metal Cutting* SAWS

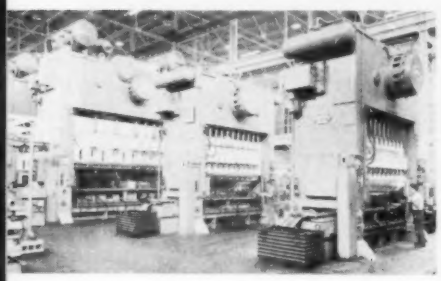
Better Machines—Better Blades

ARMSTRONG-BLUM MFG. CO. • 5700 Bloomingdale Avenue • CHICAGO 39, ILL.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-150

SPECIAL PRESSES SPEED PLANT OPERATION

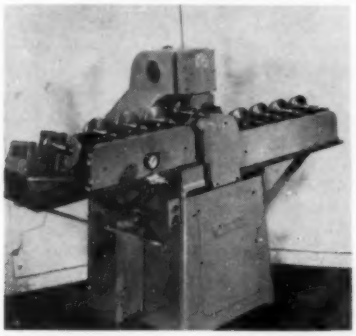
These transfer feed presses, built by Danly Machine Specialties, Inc. for Ford Motor Co.'s Sterling plant will perform drawing and piercing operations on parts used in ball-joint suspension units. The units accommodate up to 10 dies with each die performing a



separate operation. Six such presses were built for Ford Motor in 600, 1000 and 2,000-ton capacities. The 600-ton units are producing approximately 5000 finished parts per eight-hour shift, while the 1000-ton presses are producing approximately 2000 parts per eight hours.

AUTOMATIC MARKING FOR PINION GEARS

Code numbers are marked automatically on pinion gears as they came off the production line at the rate of 900 parts per hour, on this single-purpose unit, made by Geo. T. Schmidt, Inc. Feed is by conveyor chain which carries the pinons under the concave lettering

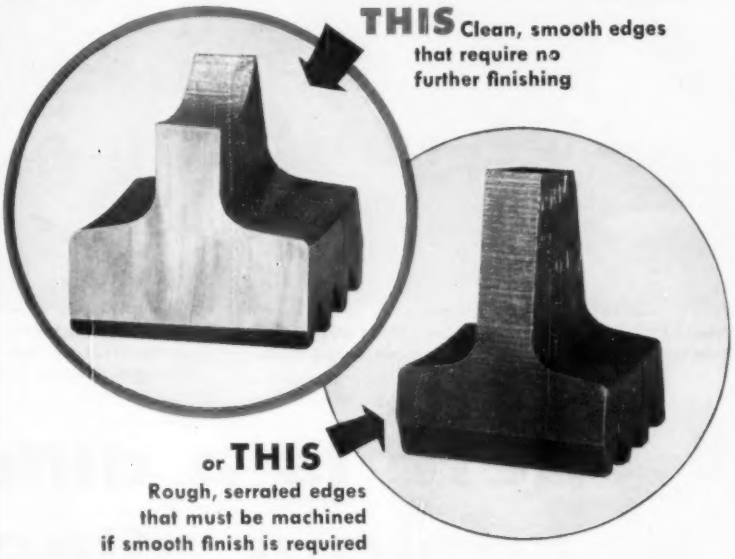


tool. Parts are rolled into a locator chamber and from there picked up by chain feed, thus accurately locating the impressions. In the die holder, a pneumatic cushion accommodates diameter variations and assures uniform depth of marking on both low and high tolerance limits. After pinions are marked, they are rolled to the discharge chain, from which they are ejected.

Abrasive Cutting | *the best way to cut many materials the only way to cut some*

Campbell Cut-Off Machines

WHAT KIND OF A CUT DOES YOUR JOB REQUIRE?


THIS Clean, smooth edges that require no further finishing
or THIS
Rough, serrated edges that must be machined if smooth finish is required

•The smooth cut—made on a CAMPBELL Oscillating Wet Abrasive Cut-Off Machine and the just-right ALLISON Abrasive Wheel for the job—saves a grinding operation at a Midwest gear plant.

Another combination of CAMPBELL Cut-Off Machine and ALLISON Wheel cuts stainless steel tube twice as fast as by other methods for a large aircraft manufacturer.

Can you cut tough K Monel, 4¾" dia., in two minutes per cut by present methods? Whatever your problem, our abrasive cutting specialists can improve your cutting operation and save you money.

OSCILLATION makes these big cuts with speed and economy

• The cross section of gear teeth (*shown left above*) is cut smooth, fine-finished and ready for metallurgical study.

It results from the wet cut of an Oscillating CAMPBELL Abrasive Cut-Off Machine with abundant coolant applied just where it does the most good. The Oscillation of the ALLISON Abrasive Wheel, the right one for the job, handles big cuts like this with speed and economy.

If your cutting involves alloy or high carbon steel, this CAMPBELL-ALLISON combination just can't be beat.

Let us send you this book

ACCO

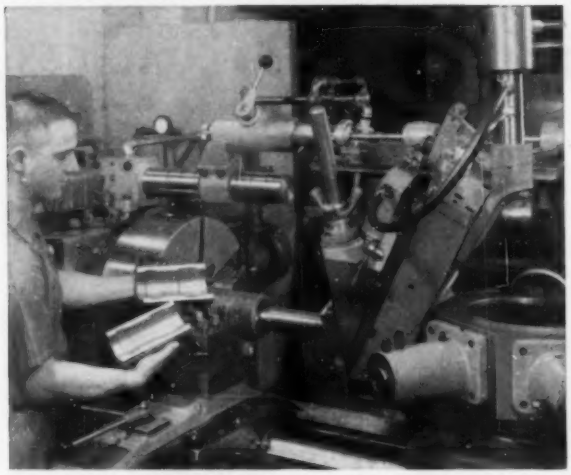
TRADE MARK

Campbell Machine Division
AMERICAN CHAIN & CABLE

945 Connecticut Avenue • Bridgeport 2, Connecticut

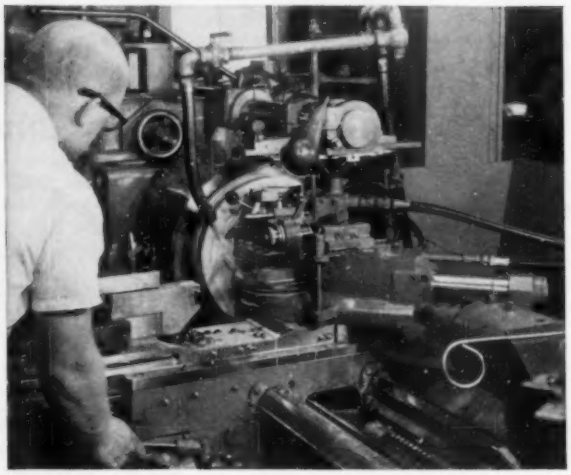
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-151

Available on Warner & Swasey 3-A and 4-A Saddle Type Turret Lathes.



NEW WARNER & SWASEY HEXAGON TURRET CONTOURING SLIDE TOOLS—Exclusively designed for contour boring work.

Available on No. 5 Ram Type and 2-A, 3-A and 4-A Saddle Type Turret Lathes.



WARNER & SWASEY CROSS SLIDE CONTOUR ATTACHMENTS—The only turret lathe contour attachments that give you both *contour turning* and *cross center contour facing* in one unit.

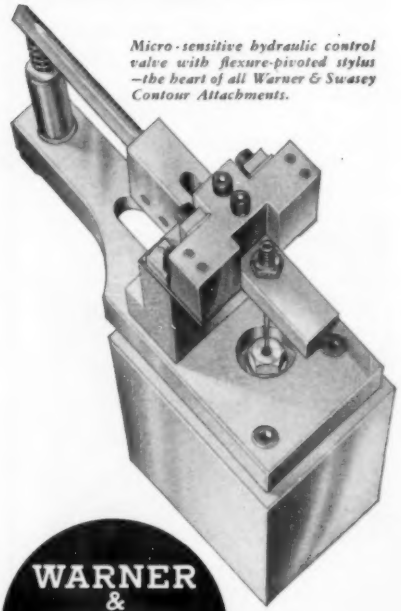
There is a difference in contour attachments

ON WARNER & SWASEYS, the difference is BASIC CONTROL. Translating the touch of the tracer stylus on the template to a precise, powerful cutter feed on the workpiece is the job of the "Micro-Sensitive" control arrangement used on all Warner & Swasey contour devices. A unique flexure-pivoted stylus and an instrument-quality hydraulic control valve provide unmatched sensitivity, fast response, and accuracy in the action of the contour units.

These controls eliminate lost motion, assure precise return of the cutter for exact machining of identical diameters that are separated like this:

Ninety-degree faces like this are made flat and square, properly located longitudinally on the part without need for compensations in the template form—template and part contours are exact duplicates.

Exceptional accuracy of these controls is matched only by Warner & Swasey's dependability and rugged construction. Individual laboratory inspection assures the quality of each "Micro-Sensitive" control valve.



Micro-sensitive hydraulic control valve with flexure-pivoted stylus —the heart of all Warner & Swasey Contour Attachments.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS ... WITH A WARNER & SWASEY

TOOLS of today

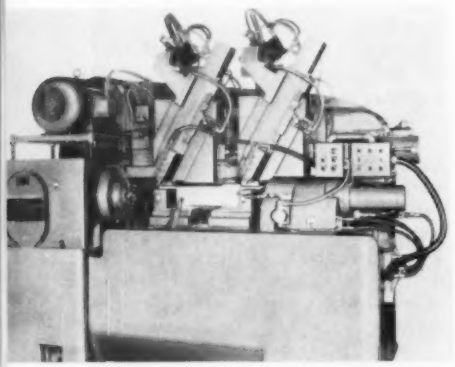
Double Tracer Lathe

Parts normally turned with multiple tooling and requiring separate machines for rough and finish operations can be handled in a single setup on this double tracer lathe.

On this unit two tracers can be mounted in a variety of combinations for best efficiency on any particular installation. Possible basic tracer combinations are: either right or left-hand mounting of tracers or combination of both; tracers mounted in tandem with a single hydraulic feed cylinder; individual feed cylinders supplied for each tracer.

Machining cycles are automatic and can be preselected for the particular operation involved. Two different machining sequences are possible: traversing rear carriage operates first to perform multiple tool roughing operations after which the top carriage tracer slides move in for template-controlled tracer turning; or top carriage mounted tracers perform their turning after which the rear slides are used for form tool grooving and undercutting operations.

Because of machine design, operator has a clear view of the tracer stylus, cutting tool and workpiece at all times. Adjustments for setup and tool wear are within reach of the operator in his normal work position.



Three basic sizes are available: Models HDT-8, HDT-12 and HDT-16, with the swing over carriages being 11½, 13 and 17 in. respectively. Parts 24, 36 and 48 in. can be handled by the three models.

Either a constant spindle speed or an adjustable speed drive can be supplied with these lathes.

Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.

T-12-1531

Electronic Gage Units

This high-speed electronic gage team consists of a small electronic pickup cartridge, called an Electrojet, which can be incorporated in new and existing gages and precision instruments, and a portable electronic amplifier, called an Accutron.

The Electrojet is small, compact, easily mounted, and requires no pickup calibration. It is a transducer-type gage cartridge ⅜ in. in diameter by 1⅞ in. long. The cartridge has a total stylus travel of approximately 0.110 in. Pretravel is approximately 0.005 in. Depending upon amplification, effective gaging travel is up to 0.004 in. with an over-travel of approximately 0.100 in. A positive stop at the end of plunger over-travel protects the unit against damage. The Electrojet can be used with the full range of Accutron amplifications. The amplifier has dual amplifications that can be switched from one to another without realignment of the indicating meter mechanism.

The amplifier, which operates on 110-v-60-cycle ac, is unaffected by line voltage fluctuations from 65 to 150 volts. It has a specially designed electronic circuit with built-in voltage compensation that permits fast indication without drift or shift in amplification.

It is available with dual amplifications of either 1000/2000; 2500/5000; 5/10,000; 10/20,000; or 20/40,000:1.

The 4-in. meter scales are available with graduations over a range of 0.0001 in. for 1000:1 amplification and of 0.000001 in. for amplifications of 40,000:1.

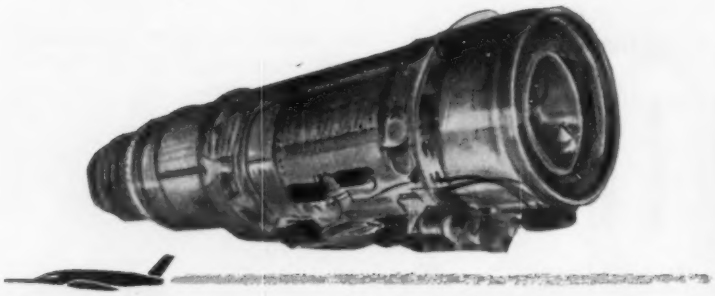
The Sheffield Corp., Dayton 1, Ohio.

T-12-1532

Deburring Unit

Continuous deburring of finish machined cast iron or nonferrous parts at rates ranging from 250 to 350 per hour can be attained in production with this index type Burr-Blaster for in-line installations. The machine is designed for removal of fragmentary burrs not caused by upsetting of metal.

Parts enter at the front of the ma-



TINIUS OLSEN

Helps Take the "Shakes" Out of Supersonic Jets

Whirling at speeds in excess of 10,000 rpm, turbine and compressor stages within modern jet engines must be accurately balanced to check destructive vibration.

Tinius Olsen has led in the development of specialized machines that balance jet turbine and compressor stages with unmatched accuracy and at maximum production rates. Awkward, manual handling of parts is eliminated by this conveyorized machine. Complete safety is assured by the air operated shroud which must be lowered before balancing can be started.

Both the amount and angle of any unbalance are shown automatically on the large Electdyne meters as soon as the part reaches balancing speed.

This Tinius Olsen Jet Component Balancing Machine is just one of a complete line of standard and specialized balancers—all of which incorporate the exclusive Olsen Electdyne Indicating System.

Write today for additional information

One of the compressor stages of a jet engine is set for rapid accurate balancing on an Olsen Electdyne.

TINIUS OLSEN
TESTING MACHINE COMPANY
2110 EASTON ROAD • WILLOW GROVE, PA.

Trademark Reg. U.S. Pat. Off.

Testing and Balancing Machines

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-154

chine and either roll or slide down a track to the loading station where they are clamped automatically. The work-holding fixture is indexed, elevating the workpiece into the blasting cabinet, where the part is rotated continuously during the blasting operation to assure uniform burr removal. At completion of the Burr-Blasting operation the fixture is indexed to the unload station. Here the workpiece is stripped from the fixture and slides or rolls down the exit chute.

Either manual or automatic loading and unloading can be used. The unit operates on normal plant air pressures.

Modern Industrial Engineering Co., 14230 Birwood Ave., Detroit 38, Mich.

T-12-1541

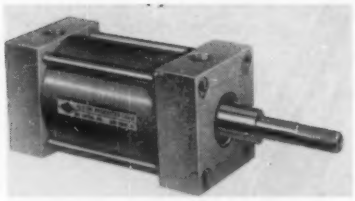
USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Double-Acting Cylinders

Model E double-acting cylinder with elliptical nonrotating piston rod is available in 1¾ and 2½-in. bores for applications which require accurate register of the piston rod without external guides.

Development of the Alkon Model D cylinder, it has 3-way flush rabbet mounts as standard equipment. The radical rod configuration is based on experience with the widely used single-acting cylinder with nonrotating rod, and is designed to fill the need for the nonrotating feature in a double-acting cylinder, where heavier return thrust is desired.

The elliptical bushing is adjustable



to permit compliance with different rod fit requirements, as well as to compensate for wear.

The cylinder, rated 250 psi air, 500 psi water or oil, is available with all standard interchangeable mounts, in all standard strokes, cushioned or noncushioned.

Alkon Products Corp., 200 Central Ave., Hawthorne, N. J. **T-12-1551**

Aluminum Paint

Temperatures up to 1700 deg are withstood by this aluminum paint without blistering or burning.

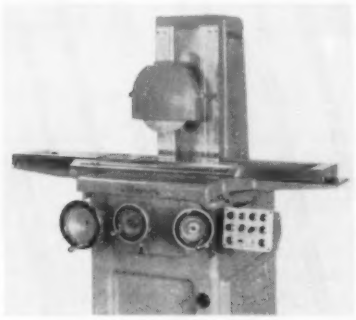
Identified C-I Extra High, it is composed of a clear silicone base with a special aluminum flake pigment. It air dries to a bright finish in approximately 30 minutes. When heated, it virtually fuses with the surface upon which it is applied to form a metal coating that resists moisture, corrosion, mild acids, alkalis and industrial fumes.

It can be applied by either brush or spray gun.

Chem Industrial Co., 3784 Ridge Rd., Brooklyn 9, Ohio. **T-12-1552**

Surface Grinder

Reid-O-Matic 824 power-operated surface grinder, designed for both production and toolroom use, handles workpieces up to 8 by 12 in. in size.



Push-button control of power rapid traverse for cross feed and rapid power elevating head simplifies operation. Both table speed, from 0 to 75 fpm, and cross-feed drive, in increments from 0.001 to ¼ in., are dial controlled and adjustable. The elevating handwheel has a slip ring for zero resetting and vernier for adjustment in 0.0001-in. increments.

A 2-hp cartridge type motorized spindle with a 4-in. diameter shaft is mounted in the head by four specially designed bill binders. The spindle mounts a 12-in. wheel for 1800-rpm operation.

Low-pressure automatic lubrication provides constant protection of moving parts.

Reid Brothers Co., Inc., Elliott St., Beverly, Mass. **T-12-1553**

Heavy-Duty Power Quill

This Super 80 heavy-duty power quill develops 1½ hp at the quill, and provides a continuously-adjustable speed range from 7,000 to 25,000 rpm. A compact but separate electric control with a simple dial permits easy selection of the exact speed desired. The control provides a voltmeter calibrated in rpm, a master switch, a pilot light and a fuse for overload protection.

Standard equipment includes a precision collet chuck with a capacity to ½ in. Solid quill extension accommo-

IDENTITY

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These two precision component parts require equally precision, perfectly legible marking on specially designed Matthews Machines for positive identification and assembly. Regardless of your product, let Matthews provide engineered, custom-built Marking Tools for every production rate.

MARKING TOOLS
FOR MODERN INDUSTRY

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CHICAGO • BOSTON • PHILADELPHIA • CLIFTON • JACKSONVILLE

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-155

Does VOLKSWAGEN bother *Cadillac?*

We don't make CADILLAC air cylinders and we don't pretend that we do . . .

We do claim that we make very good cylinders at very good prices:

BORE	BASIC PRICE	ADD PER " OF STROKE
1⅛"	$15.50	$.35
1½"	$20.50	$.50
2"	$25.50	$.55
2½"	$29.50	$.65
3"	$32.50	$.95
4"	$47.50	$1.20

We furthermore claim that we work hard to ship from stock and our sales chart tells us that we are being successful on all accounts — PRICE, QUALITY, SERVICE.

Besides cylinders, we also make the ALLENAIR line of AIR VALVES, AIR CLAMPS and DIAL FEED TABLES and if we could tell you right here all there is to tell you about what we offer and how those products can increase your PRODUCTION at MINIMUM COST we wouldn't need the $1.25 24-page catalogue that is available for free this month to anyone seriously interested.

THE A. K. ALLEN CO. TE-126
57 Meserole Ave., Brooklyn 22, N. Y.
Name.....
Company.....
Address.....
City..... Zone..... State.....

P.S.—*The cylinder pictured is a Factory Reject. The only rods available are straight ones and made out of #416 Stainless Steel ground and polished stock and repolished after machining. The bearing is nylon.*

The answer to the question on top of this page is: *Not one bit. There is a market for both!*

ALLENAIR THE A. K. ALLEN CO.
57 Meserole Ave., B'klyn 22, N. Y.

INDICATE A-12-156-1

dating wheels with up to ½-in. ID and 2½-in. OD also is available. Specially designed universal or plane type mounts permit easy mounting on standard machine tools for either single or multiple operations. This tool attachment is designed to permit milling, grinding or finishing to tolerances of 0.0001 in.

Precise Products Corp., Racine, Wis. **T-12-1561**

Hydraulic Fluid

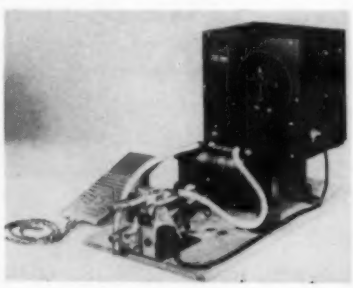
Fire-resistant hydraulic fluid, particularly for systems operating at temperature above 150 F and for heavily loaded pumps and bearings, is a fortified synthetic material known as Hough-to-Safe 1020. In addition to its high film strength and lubricity, it is fortified with rust preventives and antifoaming agents.

E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa. **T-12-1562**

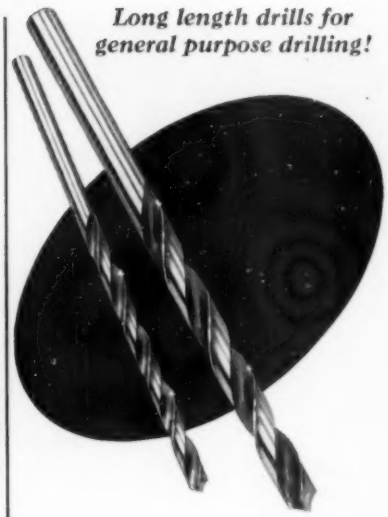
Welding Unit

This TW-1 package welding unit, designed for production hand welding of small parts, incorporates a single electrode welding head, a 1 kva a-c transformer, heat control, timer and foot switch.

It is constructed to provide constant,



Long length drills for general purpose drilling!



ACE

TAPER LENGTH DRILLS

Feature for feature, you can't beat Ace Taper Length Drills. First, because they're made of the finest quality high speed steel properly heat treated to assure the ultimate in uniform hardness. Second, because they're produced by the Ace-originated "ground-from-the-solid" process to give them smoother, more highly polished flutes with keener, stronger cutting edges. And finally, because they cut faster, last longer, give you more production per drill at lower cost.

Call your local Ace Drill Distributor today!

NEW CATALOG covers the entire line of Ace "Ground-from-the-Solid" High Speed Steel and Carbide Drills, Reamers, Drill Blanks and Special Drills. Send for it today!

ACE DRILL
ADRIAN, MICHIGAN
ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

INDICATE A-12-156-2

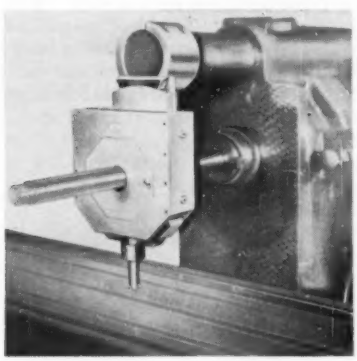
even pressure during the welding operation, insuring good amalgamation while the metals are in a plastic state.

A precision limit switch, operating at a 5 percent lag behind the electrode closing, assures continuous welding. It can also be adjusted for percussion welds.

Federal Tool Engineering Co., 1390 Pompton Ave., Cedar Grove, N. J.
T-12-1571

Mill Attachment

Horizontal milling machines can be changed into vertical shapers in a few minutes with this Mill-Shape attachment for precision high-speed work. It fits directly on any regular horizontal milling machine arbor, close to the mill frame or as far out as the arbor will



permit. It is easy to handle and weighs about the same as a conventional milling machine vise.

The Dorden Mill-Shaper attachment is made in two models. Model MS-1 has a nonadjustable 2½-in. stroke and no swivel features; Model MS-2, which swivels in two directions for taper shaping, has an adjustable stroke up to 3 in.

Dorden & Co., 18750 Fitzpatrick Ave., Detroit 28, Mich. **T-12-1572**

Drilling—Tapping Press

Automatic drilling and tapping operations may be performed on this Drill-N-Tap press, which provides quick change-over at the flip of a switch. Drill bushings are removed when tapping is desired. The tap fits into the chuck; no extra head is necessary. Electrically controlled, self-reversing motor withdraws the tap by reversing spindle rotation. No clutches are needed. Direct tool approach results in little tool overhang, low tool breakage, reduced scrap losses and close mounting to the work fixture for fast cycling.

Infinite adjustment of both forward and retract air pressures on the two-

Do you need better ways to strip paint?

When tough finishes resist your present stripping methods, you may need help on some of these problems:

1 How to strip oil-base paints . . . synthetic enamels . . . alkali-resistant plastics . . . resin-base paints . . . japans . . . wrinkle finishes . . . nitrocellulose lacquers . . . alkyds . . . phenolics . . . ureas.

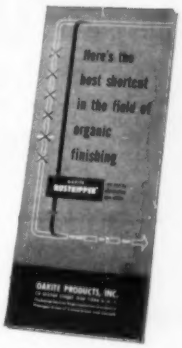
2 How to strip zinc chromate primers without etching aluminum.

3 How to strip paint from vertical surfaces and undersurfaces where thin-bodied strippers run off without doing their work.

4 How to strip metal parts that are too large to be soaked in tanks.

5 How to strip paint, pigment residues, phosphate coatings and rust in one operation.

6 How to strip paint from rejects, conveyor chains, racks and hooks in continuous operation.



Oakite has more than a dozen fine stripping materials for these and similar jobs.

FREE For information on problems 1, 2, 3 and 4 ask for a copy of "How to STRIP PAINT". For more on problems 5 and 6 ask for "Here's the best shortcut in the field of organic finishing". Write to Oakite Products, Inc., 58 Rector St., New York 6, N. Y.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS · METHODS · SERVICE
SCIENCE

Export Division Cable Address: Oakite

Technical Service Representatives in Principal Cities of U.S. and Canada

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-157

VULCAN Vairloy, used by Algonquin Tool & Mfg. Co., Chicago, makes dies with negligible distortion in hardening, that produce 100,000 TV bases per grind.

Solving troublesome problems

Here's another good reason why Vulcan tool steels are ahead—for present Vulcan customers and *for you.*

Algonquin Tool and Mfg. Company had a problem of making dies with absolute minimum distortion in hardening. Results were outstanding—heat treat distortion was negligible—close tolerances were met with a minimum of grinding after hardening—tools gave 100,000 stampings per grind.

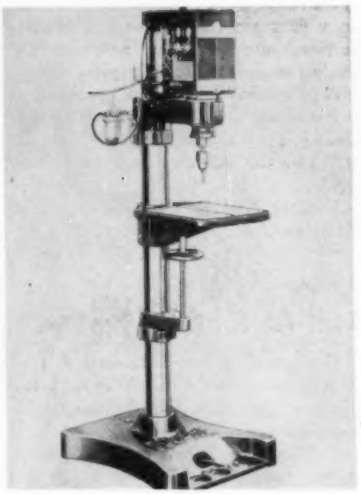
If you have a tool steel or die problem—look ahead to Vulcan. A representative is nearby.

Vulcan Crucible Steel Division

HKP **H. K. Porter Company, Inc.**
Aliquippa, Pennsylvania

Offices and warehouses in principal cities.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-158



way pneumatic system assures clean tapping threads. Left-hand, as well as standard, drills and taps can be used. Tool capacities recommended for drilling are No. 60 to $\frac{3}{8}$ in. in mild steel, or $\frac{1}{2}$ in. in cast iron, aluminum and brass; for tapping, No. 2-56 up to $\frac{1}{2}$ in.-13 in 1020 steel; $\frac{1}{4}$-in. tapered pipe tap in steel, No. 2-56 up to $\frac{5}{8}$ in.-13 in aluminum and softer metals.

The Drill-N-Tap drive heads may be quickly and easily removed and inserted into other setups.

The Dumore Co., 1300 Seventeenth St., Racine, Wis. **T-12-1581**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Dust Collector

Square type, compact, portable Dus-Kolector, Model 40, using a ½-hp motor, collects dust from medium-size grinding or metalworking equipment when these tools are used for high-speed machining of cast iron.

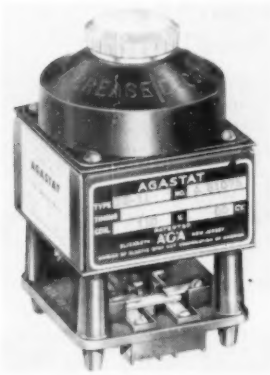
Its cabinet size is 25 in. wide x 22 in. deep x 28 in. high. Shaft, with hand knob, provides convenient means of "shaking" filters for cleaning, and without removing them from cabinet. Both glass-fiber filters and dustpan are easily reached for replacement.

With two inlets, the Model 40 has a capacity of 700 cfm, and can be used with two size 16 x 2-in. grinding wheels or two 4 in. wide abrasive belts.

Hammond Machinery Builders, Inc., 1661 Douglas Ave., Kalamazoo, Mich. **T-12-1591**

Time-Delay Relays

Developed for applications requiring frequent time adjustments, a line of Agastat time-delay relays has dial markings on the heads to permit easy calibration. Each dial is color coded to identify the timing range. Four timing ranges are available in dial head model: white, for time periods from 1/10 to 3 sec.; yellow, for 1/10 to 10 sec.; red, for 10 sec. to 2 min.; and



blue, for 30 sec. to 15 min. Each unit is adjustable within these timing ranges, and the complete range is attained by one revolution of the dial.

These relays are relatively unaffected by temperature changes from −65 to +160 F. They can be supplied for continuous a-c duty and for continuous or intermittent d-c service. They are available for a-c operation at all standard voltages from 6 to 550 volts, 60 or 25 cycles. For d-c operation, they are made for all standard voltages from 6 to 230 volts.

Electric Stop Nut Corp. of America, A'G'A Div., Elizabeth, N. J. **T-12-1592**

Gearmotor

Shaft-mounted gearmotor is designed to provide remote and automatic control for adjustable-speed drives, valves, pumps, feeders and other machines.

This light, compact unit, called the Shaftrol, mounts easily on shafts from ¼ to ⅞ in. in diameter. It is furnished with a torque arm or torque plate with resilient mounting that absorbs any run-out present in the shaft. When used on rising stem valves the torque plate is equipped with linear bushings to allow axial movement. Installed in place of standard handwheels, knobs or cranks, the Shaftrol offers remote or automatic control as an optional feature. It may be mounted horizontally or vertically with

to economize
STANDARDIZE *with* RING

precision PUNCHES and DIES

Ring Standardized Punches and Dies offer cost saving dependable performance for all of your perforating problems.

Precision volume production to rigid specifications offers

★ Low cost
★ Complete interchangeability
★ Immediate shipments from stock on Standards plus prompt delivery on Specials
★ High quality — long life

MANY SHAPES AND TYPES

Blanks — Pilots — Headless — Shoulder and Bevel Head Quills — Slug Ejector Punches — Transfer Punches

NEW! → Tough — Accurate Retainers for Ring Punches and Dies mount easily to your die set. Available in Key Type for irregular shapes.

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Gentlemen: Please send me a copy of your new, complete CATALOG #105 at once.

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FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-159

the shaft up or down.

Wide choice of output speeds and torques is provided by the many ratios of reduction gearing that can be furnished. Both single-phase and three-phase Shaftrols are available in larger sizes. Explosion-proof and other enclosures are available.

The Jordan Co., 3235 W. Hampton Ave., Milwaukee 9, Wis. **T-12-1601**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Cleaning Setup

This addition to the Sonogen® ultrasonic cleaning units, Model AP-10-B, is designed for bench-top operations in washing small, delicate, intricate parts. The instrument comprises a 36-40 kc-sec. power generator, and a cylindrical cleaning tank, with transducers hermetically sealed into the base. RF power output of the generator is 50 watts average, 200 watts peak on pulses. Tanks are of 1-pt, 1-qt, or ½-gal capacity, giving a maximum effective cleaning area of 18 sq in. Two of the smaller

tanks may be operated simultaneously, and two of the larger tanks, alternately.

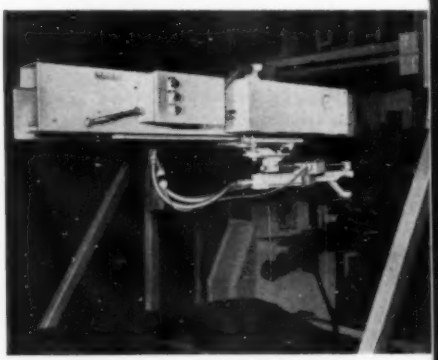
Cleaning is effected by ultrasonic activation of the solvent to remove soil from the surfaces to be cleaned. Cleaning action reaches all surfaces accessible to the fluid.

Branson Ultrasonic Corp., 37 Brown House Rd., Stamford, Conn. **T-12-1602**

Straight-Line Press Unloader

Air-powered, heavy-duty straight-line press unloader, adaptable to all types of metal-forming and forging presses is a self-contained package type. Plug-in connections to JIC standard air and 110-v electrical controls put the unit in operation. It operates on 50-psi air pressure with minimum air consumption.

The unit, called the P.A.S. straight-



line press unloader, is supported by either portable or fixed frame mountings to suit customer requirements. When installed on a press, it requires no guards, provides access for easy die setting, does not interfere with crane chains.

Speed and stroke adjustments, as well as all dimensional adjustments of the unloader can be made from floor level. Interchangeable standard-grip,

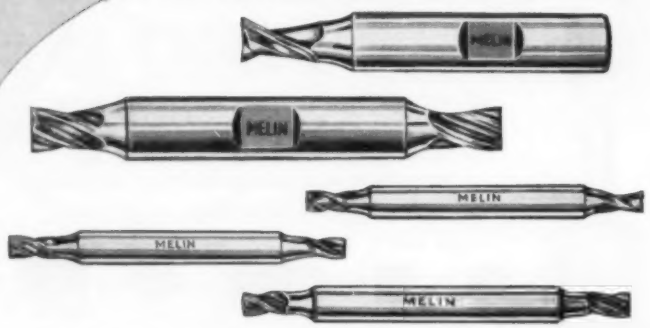
MELIN

STUB LENGTH END MILLS

with flutes shorter than regular

Offer GREATER STRENGTH*...

TWO, THREE AND FOUR FLUTE



...★ Plus an Exclusive... In addition to manufacturing a complete line of End Mills, the Melin Tool Company makes several standard Stub Length Mills exclusive of other tool manufacturers.

The new Melin Tool Catalog No. 54-C lists the specifications on these all inclusive Stub Length Tools... and... they offer greater strength and less breakage. Write for your catalog... today.

Representatives in Principal Cities

MELIN TOOL COMPANY, INC.

3372 West 140th Street
Cleveland 11, Ohio

MELIN TOOL CO. INC.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-160

chisel and vertical flange jaw assemblies, as well as vertical-lift attachments can be provided for the specific operations.

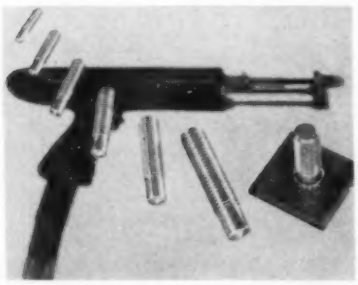
There are four standard models: Model 240 has stroke adjustable from 12 to 24 in.; Model 360 has an 18 to 36-in. stroke; Model 420 has 28 to 42-in. stroke, and Model 480 has stroke adjustable from 34 to 48 in. Jaw assemblies are made in three models: Model 715 with a 7 in. max stroke and a 1½ in. diam air cylinder; Model 820 with an 8 in. max stroke and a 2 in. diam cylinder; and Model 825 having a maximum stroke of 8 in. and a 2½ in. diam cylinder. Jaws with longer strokes are available on special order.

Press Automation Systems, Inc., 18616 Wyoming Ave., Detroit 21, Mich.

T-12-1611

Threaded Welding Stud

Low-cost, granular fluxed threaded end welding stud, designated Type CP, has tensile strength as much as 13 percent greater than the former standard



MG studs and provides improved welding qualities. Templates now being used with Nelson MG studs can be used with CP's up to and including ½-in. diameter.

Nelson Stud Welding Div. of Gregory Industries, Inc., Lorain, Ohio.

T-12-1612

Motion Meter

This MF-2 Speed-Feed meter measures and indicates linear rates of travel and revolutions per minute on all types of machines. A large illuminated meter gives the reading directly, with push-button selection of four scale ranges from 0—1 to 0—125 ipm.

Models are available with four feed ranges or with combinations of feed rate and rpm scales. The small, fixed tachometer pickup has no moving parts and is easily mounted on the machine. A hand-held tachometer pickup also is available.

Neither pickup nor indicator can be harmed by overspeeding or sudden

NEVER LOADS THE WHEELS

K-7 solutions do not load work wheels, and this important advantage means (1) fewer dressings, (2) longer wheel life and (3) a true ground finish (rather than a burnished or smeared finish). In addition, with K-7 (because it does not load) you can often use a harder (1-2 grades) and finer (10-20 points) grit wheel, resulting in better work at lower cost.

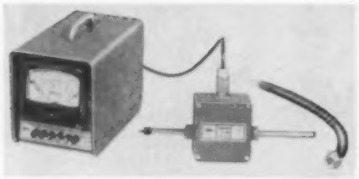
Investigate K-7 for use in grinding all steels, cast and malleable irons, titanium, carbon, rubber, ceramics and plastics. (Not recommended for non-ferrous metals.) It is an all-chemical water soluble liquid concentrate, transparent and colorless in solution. It is non-foaming and runs absolutely flat under all conditions. Low pH (alkalinity) makes it easy on the skin. Send for details.

CONCENTRATION TEST KIT

With this pocket size Concentration Test Kit K-7 users can check the concentration of the solution right at the machine. Only takes a minute or two.

THE Lusol LINE
BETTER PRODUCTS FOR BETTER METALWORKING

F. E. ANDERSON OIL COMPANY INC.
BOX 213, PORTLAND, CONNECTICUT



starts and stops. For rapid installation, the pickup can be fastened magnetically.

Maico Co., Inc., Industrial Div., 21 N. 3rd St., Minneapolis, Minn.

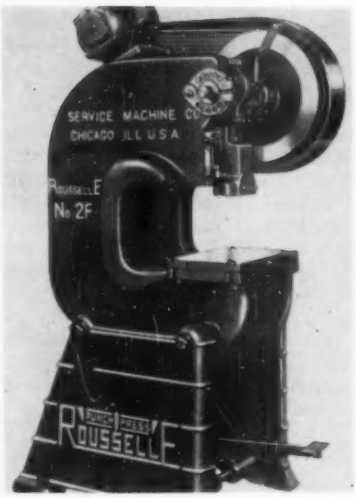
T-12-1621

OBI Press

Advantages of an open-back, inclinable press and those of a deep throat unit are combined in this 15-ton Model 2F Rousselle press to provide 12 in. of throat room, measured from ram center to frame.

Frame of the unit is heavily reinforced to assure accuracy and uniformity of presswork. Other components are close together to minimize shaft deflection; adjustable V-type guides maintain alignment.

The unit delivers 180 spm, with a



standard stroke of 2 in. Die space (slide down and adjustment up) is 8 in. Opening in the bed is 8 in. in diam. Width of opening through the back is 10½ in.

Service Machine Co., 2310 W. 78th St., Chicago 20, Ill.

T-12-1622

WALKER...

and a great industry

For more than fifty years automotive production has relied on Walker holding devices. One of the most popular chucks in the Detroit area is Walker 617 CG (concentric gap) type, a rectangular chuck that combines longitudinal and transverse gaps. Produced in sizes to meet all holding requirements.

Walker engineers can solve any holding problem.

What is yours?

O. S. WALKER CO. Inc.

WORCESTER 6, MASSACHUSETTS

Original Designers and Builders of Magnetic Chucks

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-162

Pushbutton Control Switch

Gold-N-Ring sealtight pushbutton 600 v ac-dc control switch is built to mount in $1\frac{13}{64}$-in. diameter holes on standard panel mounting centers and will accommodate panel thicknesses of from $\frac{1}{16}$ to $\frac{1}{4}$ in. in increments of $\frac{1}{32}$ in. It is designed for complete interchangeability of units and their components. Switches can be obtained in flush-plate or box type mountings. They are dust, oil and water tight, of heavy-duty construction and meet all JIC and NMTBA specifications.

Single and double-pole contact blocks can be used interchangeably with the

several different types of Gold-N-Ring pushbutton and selector operator heads. Design permits easy access and ample space for secure wiring or use of stake-on lugs without interference. Heavy-duty terminal screws prevent stripping during installation. Brass inserts molded into contact block secure stationary contacts and provide maximum thread support for terminal screws.

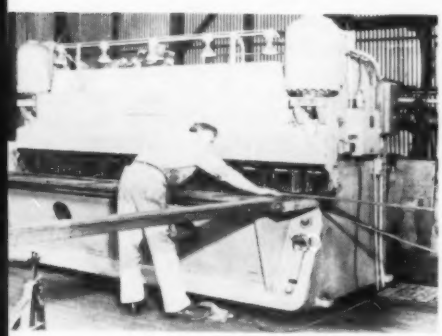
Interchangeable collars are supplied in three different heights to enable easy changing from a flush to extended type button. Buttons are available in an assortment of nonfading colors to conform with standard codes.

Electrical Mfg. Div., National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.

T-12-1631

Hydraulic Shear

Gap type, heavy-duty hydraulic shear cuts oversize sheet or heavy plate accurately, rapidly and without noise. It cuts narrow strips or trims fine edges from plates or sheets and does not mark soft aluminum or polished stainless. A



prime feature is the unit's simple hydraulic system, which minimizes maintenance and reduces shock.

The unit will shear any piece between 20 ga and full capacity with single setting of blade clearance.

Pacific Industrial Mfg. Co., 848 Forty-Ninth Ave., Oakland 1, Calif.

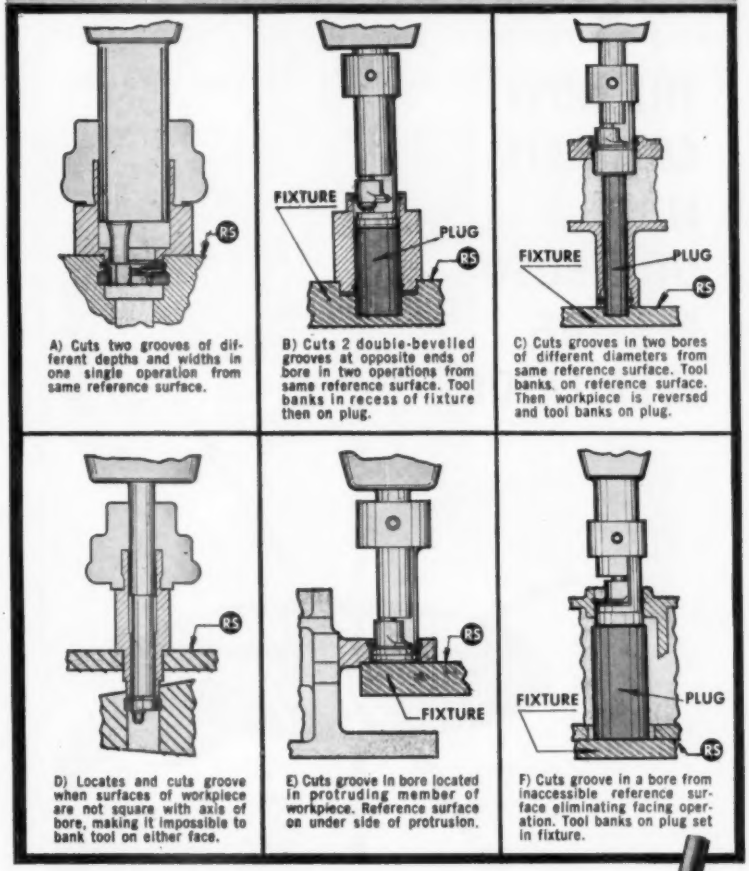
T-12-1632

Gage and Feed Grinding Attachment

An electronic gage and feed system for centerless grinders automatically gages the parts being ground, automatically adjusts the grinder to compensate for wheel wear and automatically records the size. Finished work is continuously gaged as it emerges from the machine and the information from the gaging unit is fed back to the machine, automatically adjusting for wheel wear and all other variables that affect size.

The Size-O-Tron consists of a gage

Even Unskilled Labor Can Use This Versatile Tool Accurately! It Simplifies Internal Grooving Problems, Cuts Production Costs!



A) Cuts two grooves of different depths and widths in one single operation from same reference surface.

B) Cuts 2 double-bevelled grooves at opposite ends of bore in two operations from same reference surface. Tool banks in recess of fixture then on plug.

C) Cuts grooves in two bores of different diameters from same reference surface. Tool banks on reference surface. Then workpiece is reversed and tool banks on plug.

D) Locates and cuts groove when surfaces of workpiece are not square with axis of bore, making it impossible to bank tool on either face.

E) Cuts groove in bore located in protruding member of workpiece. Reference surface on under side of protrusion.

F) Cuts groove in a bore from inaccessible reference surface eliminating facing operation. Tool banks on plug set in fixture.

Amazingly versatile! Your toughest recess cutting problems can be met simply and efficiently with the Waldes Truarc Grooving Tool because it offers a whole range of possibilities beyond the range of ordinary recessing tools.

Wide Cutting Range! The Waldes Truarc Grooving Tool comes in 5 models...enabling you to cut accurate grooves in housings with diameters from .250 to 5.00 inches.

Send Your Problems to Waldes! Send us your blueprints...let Waldes Truarc Engineers give you a complete analysis, price quotation and delivery information on the most economical tool set-up for your particular job. There is no obligation!

Write NOW for a 20-page manual containing full information on Waldes Truarc Grooving Tool

WALDES TRUARC® GROOVING TOOL

Made by the Manufacturers of Waldes Truarc Retaining Rings
WALDES KOHINOOR, INC., 47-16 Austel Place, L. I. C. 1, N. Y.
Waldes Truarc Grooving Tool Manufactured Under U. S. Pat. 2,411,426

TE 128

Waldes Kohinoor, Inc., 47-16 Austel Pl., L.I.C. 1, N. Y.

Please send me your new 20-page technical manual on the Waldes Truarc Grooving Tool.

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Norgren

THE MOST COMPLETE LINE OF AEROSOL BEARING LUBRICATORS

1/3 Pt. Oil Capacity

Model	Bearing-inch Rating
30-40-2S	32
30-40-3S	32

½ Pt. Oil Capacity

30-41-2S	32
30-41-3S	32

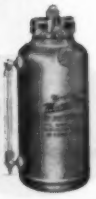
1 Qt. Oil Capacity

Model	Bearing-inch Rating
S3406-2S	32
S3406-6S	200
S3406-8S	300

2 Qt. Oil Capacity

Model	Bearing-inch Rating
S3408-2S	32
S3408-6S	200
S3408-8S	300

MICRO-FOG by Norgren

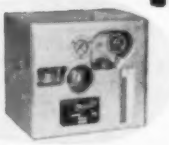


1¾ Gal. Oil Capacity

Model	Bearing-inch Rating
X3400-2S	32
X3400-6S	200
X3400-8S	300

4½ Gal. Oil Capacity

Model	Bearing-inch Rating
Y3400-2S	32
Y3400-6S	200
Y3400-8S	300



2 Gal. Oil Capacity

Model	Bearing-inch Rating
33AH-16	300
33AF-16	1000

One Lubricator Per Machine—A lubricator for every size job, 1000 bearing inches and less.

Visual Oil Feed—Indicates proper operation of lubricator.

Lower Bearing Temperatures—Dissipates heat better, faster.

Big Savings in Equipment—No pumps, or large reservoirs, fewer oil seals, less maintenance. Manifolding reduces equipment needs.

Oil Always Fresh, Clean—No recirculation of contaminated lubricant.

Better Lubrication—Automatic continuous application of airborne oil fog.

C. A. NORGREN CO.
3447 So. Elati St., Englewood, Colorado

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Pioneer and Leader in Oil-Fog Lubrication Since 1930

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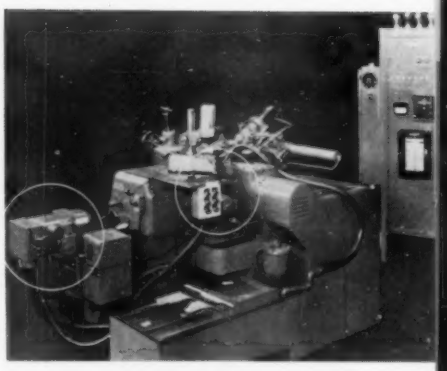
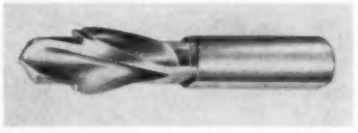


control unit and a machine adjusting control unit. Attached to a conventional centerless grinder, it is capable of maintaining a tolerance or spread of 0.000050 in., disregarding the inherent inaccuracies of the machine. If the variation within the machine does not exceed 0.000050 in., a total tolerance of 0.0001 in. can be maintained. A practical total tolerance with a well-maintained machine on the production line is 0.000150 in.

The Kaydon Engineering Corp., McCracken St., Muskegon, Mich.

T-12-1641

Step Drills



Drills are designed for drilling two or more diameter holes simultaneously. They are available in sizes 0.190 to 5 in. in diam and lengths up to 40 in.

Hi-Duty Drill Works, Fleetwood, Pa.

T-12-1642

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

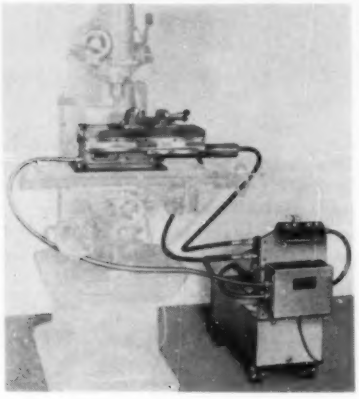
Hydraulic Slide Attachment

Compact, self-contained hydraulically-operated slide assembly can be used either as a component for special machine construction or as a mass-production attachment for toolroom milling machines.

Installation to convert any standard toolroom miller into a semi-automatic production machine requires only mounting of the attachment on the machine table, attaching hydraulic hose lines and the limit switch electric cable to the power pack, and plugging the power pack into any 110-v a-c outlet.

The attachment provides a complete cycle of rapid approach, feed, dwell and rapid return, controlled by a single pushbutton. Provision is also made for coordinating slide movements with automatic work clamping and spindle feed control.

Over-all stroke length is 8 in. Rapid approach and feed sections of the for-



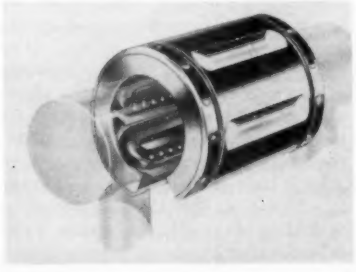
ward stroke are quickly adjusted to any desired length. Rapid traverse movement in either direction may be regulated for any desired speed up to 160 ipm max. Infinite control of feed rate permits any cutting speed from zero up to the rapid traverse rate.

Russell T. Gilman, Inc., 623 Beech St., Grafton, Wis. **T-12-1651**

Linear Ball Bearing

Shaft support members can be used anywhere along the length of a shaft traversed by these linear ball bearings, known as open type ball bushings. These bearings are designed particularly for use where unusually long shafts are essential.

Open construction of the bearing also permits adjustment of its bore diameter by use of set screws or other clamping arrangements to avoid shake or play. Low friction minimizes wear; however, if some should eventually develop under heavy loads, play can be removed easily by readjustment of the bearing bore diameter.



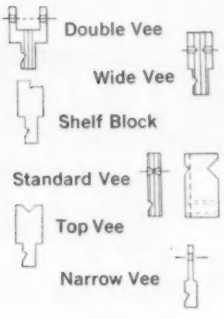
new

FOR OPTICAL GAGING

MULTI-USE FIXTURE PROVIDES LOW COST STAGING FOR MANY SMALL PARTS

Photo courtesy Eastman Kodak Co.

O. G. P. Multi-Use Fixture fits all types of optical comparators.



O.G.P's NEW Multi-Use Fixture has replaceable part holders designed for holding many types of small parts. Standard holders in varying sizes and shapes are available (see drawings above). Quickly locks into keyway with clamp.

EVERYTHING TO MAKE YOUR OPTICAL COMPARATORS MORE USEFUL

We also supply all types of standard charts, custom charts, layout accessories, fixture bases, and custom fixtures to meet your specialized requirements.

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I'd like more data on the NEW O. G. P. Multi-Use Fixture.

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OPTICAL GAGING PRODUCTS, INC.
SPECIALISTS IN PROJECTION GAGING

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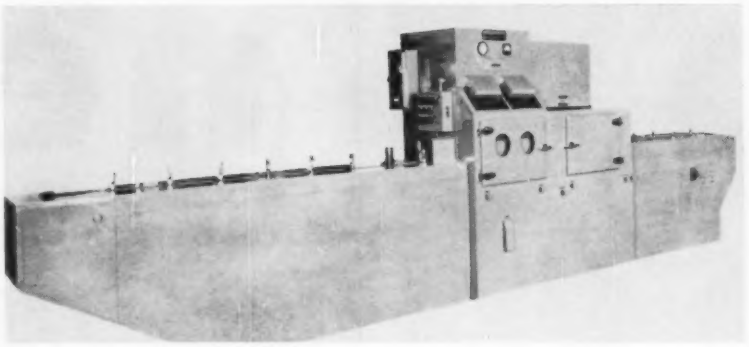
By using adjustable shaft-support members a precision antifriction way can be mounted on a relatively uneven inexpensive base. These ball bearings do not depend on the maintenance of an oil film. Open type ball bushings are manufactured to standard dimensions for shaft diameters ranging from 1 to 4 in.

Thomson Industries, Inc., Manhasset, N. Y. **T-12-1661**



Wet Blast Unit

Extended load-area conveyorized wet blast unit is designed for the high production rate deburring of automatic transmission components. The machine automatically wet blasts, deburrs, hot water rinses, rust proofs and unloads at the rate of 360 parts per hour net at 80 percent efficiency. Load section of the conveyor allows several parts to be loaded in advance, thereby freeing the operator for other duties.

Simple alteration in work-holding fixture design and blast gun arrangement makes it adaptable to the finishing of a wide range of parts.

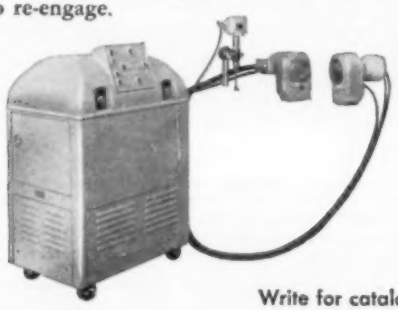
The Cro-Plate Co., Inc., 747 Windsor St., Hartford 1, Conn. **T-12-1672**

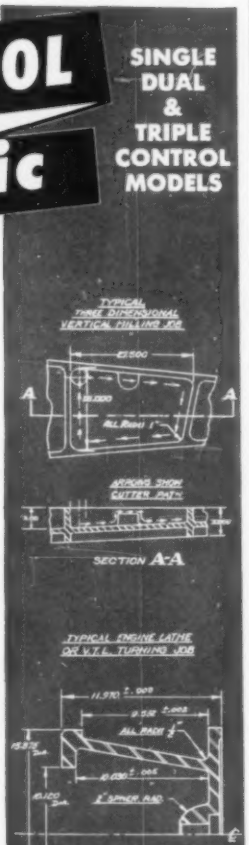
TRACER CONTROL duplimatic

SINGLE DUAL & TRIPLE CONTROL MODELS

Controls standard machine tools for contour machining no other tracer device can perform

When connected the Tracer Control Duplimatic does not interfere with conventional use of the machine tool. Push a button to disengage. Push another to re-engage.





Write for catalog.

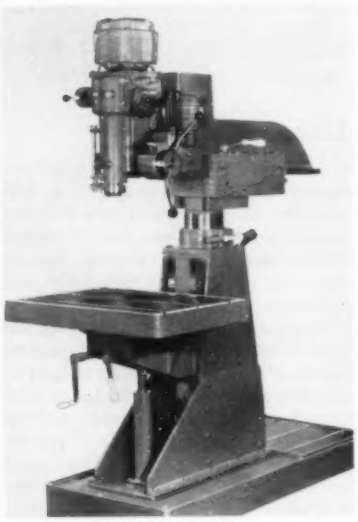
TRACER CONTROL CO.
Manufacturers of Duplimatic
595 E. Ten Mile Rd., Hazel Park, Mich.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-166

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Radial Drilling Unit

Positioning the drill head without disturbing the workpiece is permitted in this radial drilling machine by a combination of linear and angular ram movements. The tube column raises vertically and also rotates around its axis 360 deg.



The 360-deg ram rotation permits use of two work stations, one on the adjustable 20 x 28-in. table in front of the machine and the second on the fixed platform at the rear of the machine.

Drill head on the ram can be brought to within 5 in. of column or moved out to drill to center of 52-in. circle. Vertical movement of column permits a max-

imum of 53 in. from spindle nose to working surface, or minimum of 3½ in.

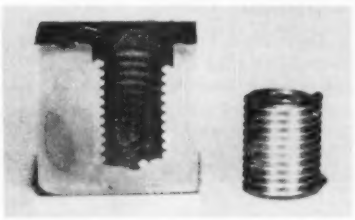
Maximum power is transmitted through geared drive, allowing use of drills up to 1¾ in. in cast iron. Any of 8 spindle speeds, ranging from 104 to 1200 rpm, can be selected while machine is running. Gears are in constant mesh, avoiding possibility of gear damage when changing speeds.

The #4 Morse taper spindle travels 6 in.

I. O. Johnsson Co., 7248 St. Louis Ave., Skokie, Ill. **T-12-1671**

Thread Inserts for Castings

Developed specifically for sand-casting operations, these inserts are tightly wound to prevent flow of hot metal into the female threads and maintain correct thread pitch in the casting. Shrinkage of the cast metal on cooling is compensated for with a slightly oversize coil. Use of stainless steel inserts



avoids need for drilling and tapping or moving of heavy castings from casting floor to machine shop.

In foundry use, the close-wound insert is placed directly in the mold on sand cores and the molten metal flows around the exterior, forming a fusion bond. After casting, sand is removed from the insert, leaving the stainless steel threads. Because the coils are flexible, stresses are not concentrated around the insert and cracking of the casting is avoided.

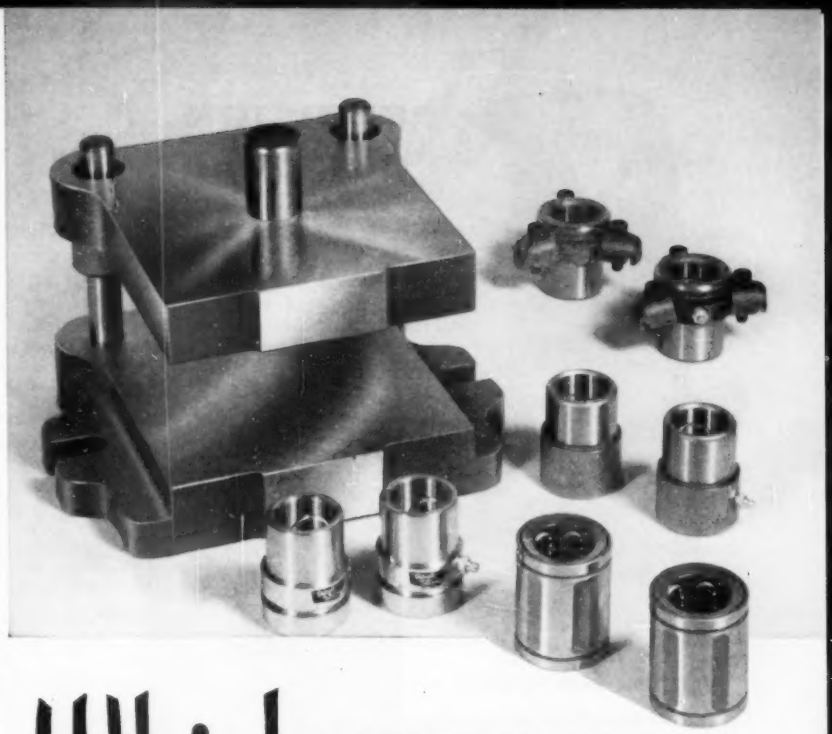
Heli-Coil Corp., Danbury, Conn. **T-12-1672**

Cutoff Unit

Model 64 wet-abrasive Cutamatic is designed to speed cutting of medium-sized bar stock, through an oscillating cutting motion. Abrasive wheel, up to 18 in. in diameter, mounted on the unit, will sever sheets, angles, channels, pipes, tubes and solids of almost any analysis in metal, ceramics or plastics.

The unit is capable of cutting 3-in. diam solids; 4-in. diam tubing and 6 by 1-in. steel plate at 90 deg to axis at speeds of approximately 4 sec. per sq in. of cross section.

Its swivel type vise can be rotated



Which BUSHING SHOULD YOU USE?

Your choice is getting broader every day. Each of the guide pin bushings above is good—in the right application. But, some of them cost more than others. Which should you use for best results consistent with cost?

That's where Detroit Die Set can help you. In our 25 years of exclusively building die sets, we've tested a good many types of bushings. Based upon these tests and performance in our customers' plants, we stock and recommend a number of types of bushings for use in our die sets.

To aid you in bushing selection, we've prepared a bulletin on the subject. Just ask for Bulletin 56, and we'll send your personal copy without delay. Detroit Die Set representatives also will be glad to personally aid you in selecting the right bushings and die sets. They're as near as your 'phone.

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FLEXIBILITY...

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...PARKER #710 makes marking a production line operation

TYPICAL CASE HISTORIES

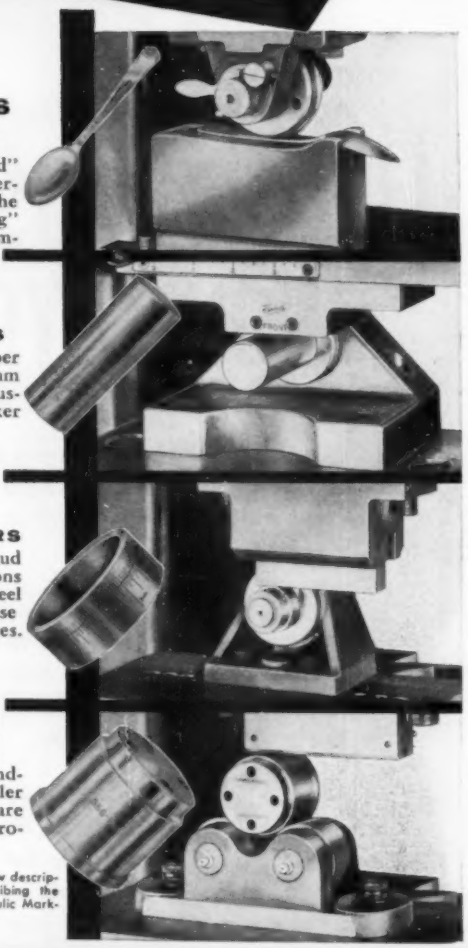
MARKING SPOONS
Using Parker #100 "standard" insert roll die holder and interchangeable segment type. The machine table's "cushioning" effect, plus proper set-up, compensated for the curvature of the spoon.

CAPACITOR SHELLS
800-1000 marked pieces per hour on thin walled aluminum shells with Parker tooling, custom built for use on the Parker #710.

GRADUATED COLLARS
Using a standard Parker stud arbor, the precision graduations were easily indented in this steel collar. Depth of mark was close ly held to specified tolerances.

SOLID ROUNDS
Marking part numbers and other legends on the outer diameter of solid rounds is no problem. Standard Parker roller bearing cradles are used on this production run.

SEND TODAY for new descriptive literature describing the Parker #710 Hydraulic Marking Machine.



THE PARKER STAMP WORKS, INC.
MARKING DIE & MACHINERY DIV.
FRANKLIN AVENUE • HARTFORD, CONNECTICUT

by Parker

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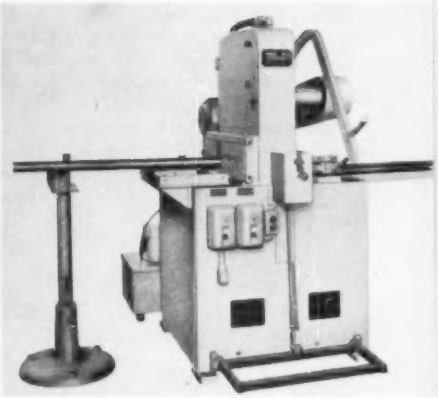
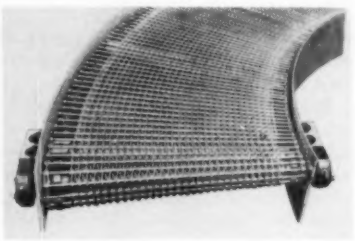


from 0 to 45 deg with a maximum opening for 45-deg cuts of 4 in. Furnished with a 10-hp motor, the tool measures 68 x 62 x 65½ in.

Campbell Machine Div., American Chain & Cable Co., Inc., 929 Connecticut Ave., Bridgeport, Conn. **T-12-1681**

Conveyor Power Turns

These Mesh-Lok power turns have a special belt edge which prevents stretching or track-jumping. In addition, wear resistant nylon rails provide smooth and quiet running, and long equipment life. The channel-weave mesh belt can be supplied in a variety of steels and



alloys, and in widths from 12 to 48 in. Units are available in 24 or 30-in. outside radius, in any degree of turn from 30 to 180 deg, and with fixed or adjustable speed up to 100 fpm.

Voss Belting & Specialty Co., 5645 N. Ravenswood Ave., Chicago 26, Ill. **T-12-1862**

Metal-Cutting Nibbler

Portable nibbler can cut corrugated sheet metal and small-diameter duct or sheet-metal pipe without distorting, curling or flattening the corrugations on either side of the cut.

It has a special nosepiece and die holder which is set at right angles to the body and permits unusual ease in handling. Because of the tool's design, diagonal cuts across the curves can be

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Literature Number	COMPANY	DESCRIPTION
A-12-156-2	Ace Drill Corp.	**Carbide Drills**—Catalog contains data on Ace "Ground-from-the-Solid" drills and hardened H.S.S. drill blanks. Page 156
A-12-203-1	Air Hydraulics, Inc.	**Presses**—New catalog describes Air Hydraulic presses. Page 203
A-12-222	Allegheny Ludlum Steel Corp.	**Tool Steel**—Catalog "Tool Steel Handbook" gives technical data on all grades of A-L Tool and Die steels. Page 222
A-12-156-1	The A. K. Allen Co.	**Air Cylinders**—Catalog describes the Allen line of pneumatic products. Page 156
A-12-191	Baker Brothers, Inc.	**Special Machines**—Catalog contains information on Baker basic machines. Page 191
A-12-196	Barnes Drill Co.	**Separators**—Catalog 3004 contains data on magnetic coolant separators. Page 196
A-12-237	The Bellows Co.	**Air Motors**—"The Story of The Bellows Air Motor" described in Bulletin BM-25. Page 237
A-12-261-3	Bischoff Chemical Co.	**Coating**—Booklet contains details on Thermo-Cote strippable protective coatings. Page 261
A-12-265	The Blanchard Machine Co.	**Grinding Machines**—Fifth edition of "Work Done on the Blanchard" and "The Art of Blanchard Surface Grinding" now available. Page 265
A-12-219	The Bodine Corp.	**Special Machines**—Bodine Case History Brochure TE-12 available. Page 219
A-12-16	Brush Electronics Co.	**Surface Finish**—Surface finish control with surfindicator described in new booklet. Page 16
A-12-48	A. G. Davis Gage & Engineering Co.	**Gage Components**—Catalog No. 9 contains data and tracing templates for special gage designs. Page 48
A-12-44	Detroit Broach & Machine Co.	**Broaching Machine**—Bulletin describes Detroit vertical single-ram machine. Page 44
A-12-167	Detroit Die Set Corp.	**Die Set Data**—Bulletin 56 contains information on selecting bushings for individual jobs. Page 167
A-12-20	The DoAll Co.	**Band Sawing**—Operational data on contourmatic band machines. Page 20
A-12-69	Eastman Kodak Co.	**Projectors**—Booklet "Projection Gaging with Kodak Contour Projectors" available upon request. Page 69
A-12-IBC	Ex-Cell-O Corp.	**Bushings**—Catalog contains data on Ex-Cell-O line of drill bushings. Page—Inside Back Cover
A-12-31	Gisholt Machine Co.	**Special Machines**—Illustrated booklet analyzes problems of balancing rotating parts. Pages 30-31
A-12-243	Hannifin Corp.	**Cylinders**—Hannifin cylinder file contains data on 5 lines of Hannifin cylinders. Page 243
A-12-IFC	The Heald Machine Co.	**Grinders**—Multiple grinding operations with single chucking described in Bulletin No. 2-69-2. Inside Front Cover
A-12-190	Lapeer Mfg. Co.	**Fixture Components**—Catalog contains engineering data on Knuvise jig and fixture components. Page 190
A-12-256	Leland-Gifford	**Drilling Machines**—Engineering specifications for Multiple spindle drilling machines described in new catalog. Page 256
A-12-172	Lepel High Frequency Laboratories, Inc.	**Induction Heating**—Induction heating applications described in illustrated catalog. Page 172
A-12-182	The Lincoln Electric Co.	**Welding**—Bulletin 1355 contains data on automatic Lincolnweld. Page 182
A-12-263	Link Aviation, Inc.	**Inspection**—Fringecount micrometer described in bulletin LP-3521. Page 263
A-12-242-2	Lovejoy Tool Co., Inc.	**Special Cutters**—Catalog No. 31 contains data on face mills; catalog 32, on side mills; catalog 33, on arbors. Page 242
A-12-66	M. B. I. Export & Import Ltd.	**Jig Borer**—Operational data on Dixi 60 horizontal optical jig borer available upon request. Page 66
A-12-160	Melin Tool Co., Inc.	**Cutting Tools**—Catalog 54-C lists specifications on Melin line of cutting tools. Page 160

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A-12-38	Metallurgical Products Dept. General Electric Co.	**Computer**—Operational data on Carboloy machinability computer, available in brochure. Pages 35-38
A-12-254-2	W. F. Meyers Co., Inc.	**Drill Bushings**—Catalog 42 contains information on Meyco carbide inserted drill jig bushings. Page 254
A-12-213	Micrometrical Mfg. Co.	**Surface Measurement**—Bulletin LT18 contains technical aspects on surface measurement. Page 213
A-12-19	The Motch & Merryweather Machinery Co.	**Milling Machines**—Bulletin S-56 describes M. & M. duplex milling machines. Page 19
A-12-264	Nice Ball Bearing Co.	**Ball Bearings**—Engineering specifications contained in Catalog No. 150. Page 264
A-12-164	C. A. Norgren Co.	**Lubricators**—Operational data on aerosol bearing lubricators contained in new catalog. Page 164
A-12-70	The Ohio Crankshaft Co.	**Induction Brazing**—"Typical Results of Tocco Induction Brazing and Soldering," available upon request. Page 70
A-12-45	The Ohio Knife Co.	**Die Data**—Bulletin contains data on OK composite die sections and clad aluminum bronze wear plates. Page 45
A-12-203-2	O'Neil-Irwin Mfg. Co.	**Shearing**—New catalog gives complete details on hand and power-operated machines. Page 203
A-12-62	The Osborn Mfg. Co.	**Brushes**—Industrial brushes and brushing methods described in catalog 300. Page 62
A-12-218-1	Pangborn Corp.	**Blast Cleaning**—Bulletin 1403 contains data on Hydro-Finish blasting. Page 218
A-12-168	The Parker Stamp Works, Inc.	**Identification**—Literature on Parker standard and special marking tools contained in catalog. Page 168
A-12-26	Putnam Tool Co.	**Cutting Tools**—Putnam tool catalog fits in a machinist's tool box for easy reference. Page 26
A-12-249	R and L Tools	**Turning Tools**—Catalog contains data on R and L turning tools. Page 249
A-12-149	Omer E. Robbins Co.	**Sign Plates**—Sign plates for angular setup problems in position-machining described in catalog. Page 149
A-12-68	The Rotor Tool Co.	**Air Tools**—Bulletin 41 contains data on new Rotor air-powered wrench. Page 68
A-12-4	Standard Gage Co., Inc.	**Measuring Instruments**—Catalog contains data on the Standard dial snap gages. Page 4
A-12-171-1	Standard Parts Co.	**Fixture Components**—Illustrated catalog describes jig and fixture components. Page 171
A-12-248	Standard Pressed Steel Co.	**Cap Screws**—Technical data and specifications are detailed in Bulletin 2193. Page 248
A-12-9	The L. S. Starrett Co.	**Indicators**—Catalog 27 describes and illustrates the Starrett line. Page 9
A-12-54	Taft-Peirce Mfg. Co.	**Gages**—Catalog 613 contains data on CompAIRator air gage. Page 54
A-12-214	The Tomkins-Johnson Co.	**Rivetors**—Bulletins 646 and 555 contain data on T-J rivetors and clinches. Page 214
A-12-61	Vascoloy-Ramet Corp.	**Toolholders**—Catalog No. VR-437 gives data on design construction of VR toolholders and VR carbide inserts. Pages 60-61
A-12-269	Verson Allsteel Press Co.	**Press Brakes**—Catalog G-56 describes the Verson line, giving designed details and specifications. Page 269
A-12-205	Wales Strippit Corp.	**Die Equipment**—Bulletin No. 12L describes Wales units for punching, notching and nibbling. Page 205
A-12-185	Wiedemann Machine Co.	**Presses**—Bulletin 101 contains data on the Wiedemann turret punch presses. Page 185
A-12-268	The Yoder Co.	**Roll Forming**—Catalog describes cold-rolled forming applications to a multiplicity of mass production needs. Page 268
A-12-251	Zagar, Inc.	**Drill Heads**—Bulletin E-12 describes the use of Zagar equipment for drilling, reaming and tapping. Page 251

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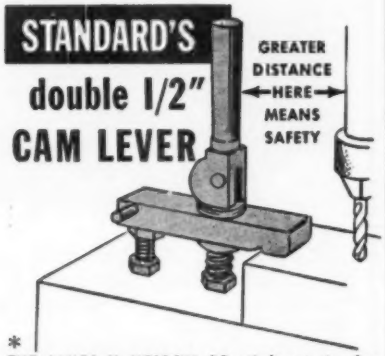

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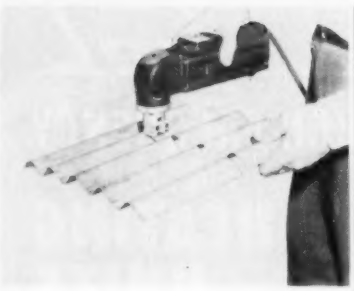


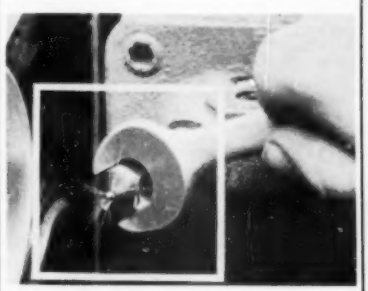
made, and circles as small as 2 in. in diam can be cut.

The tool weighs 7½ lb and is 10 in. over-all. It has a ½-hp, high-speed motor and operates from 110-v, a-c/d-c current, single-phase, with 33 in. of cutting per minute in 16-ga metal.

Fenway Machine Co., Edgemont and Clementine Sts., Philadelphia 34, Pa. **T-12-1711**

Wheel Dressing Tool

With this Turnit tool, a diamond used for wheel dressing may be turned without removing or readjusting it. Thus, a diamond may be turned frequently with consequent long wear. Because the diamond is held rigidly, there is minimum vibration. Turning of the diamond is only a matter of turning the hex head of the holder with



an open-end wrench. No extension of the tool-holder is necessary, and there is no overhang.

Smaller stones than are ordinarily required can be used with this holder because, when turned properly, diamond life is prolonged as much as four times. With this long period of sharpness, accurate dressing is assured.

Cleveland Industrial Tool Co., Inc., Skaneateles, N. Y. **T-12-1712**

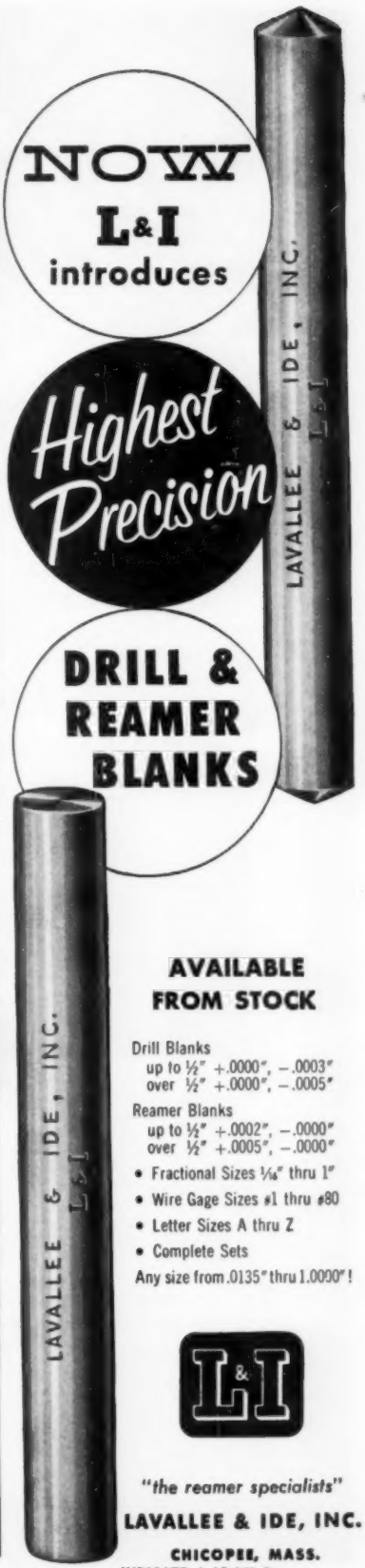
Deep Hole Drilling Unit

Designed specifically for the metalworking industries, this deep hole drilling machine drills to a depth of 24 in. with a maximum drift of 0.001 to 0.0015 in. per foot of depth. Drill spindle op-

NOW L&I introduces

Highest Precision

DRILL & REAMER BLANKS



AVAILABLE FROM STOCK

Drill Blanks
up to ½" +.0000", −.0003"
over ½" +.0000", −.0005"

Reamer Blanks
up to ½" +.0002", −.0000"
over ½" +.0005", −.0000"

- Fractional Sizes 1/16" thru 1"
- Wire Gage Sizes #1 thru #80
- Letter Sizes A thru Z
- Complete Sets

Any size from .0135" thru 1.0090"!

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"the reamer specialists"

LAVALLEE & IDE, INC.

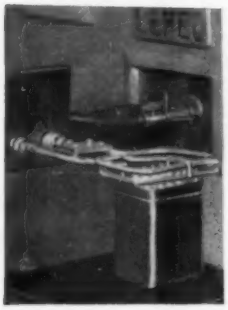
CHICOPEE, MASS.

INDICATE A-12-171-2

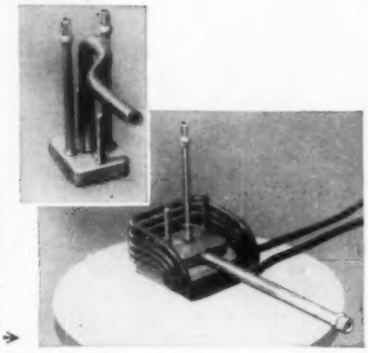
The Lepel line of induction heating units represents the most advanced thought in the field of electronics as well as the most practical and efficient source of heat yet developed for industrial heating. With a background of half a century of electrical and metallurgical experience, the name Lepel has become the symbol for quality in induction heating equipment embodying the highest standards of engineering achievement, dependable low cost operation and safety.

If you are interested in the application of induction heating you are invited to send samples of the work with specifications of the operations to be performed. Our engineers will process these samples and return the completed job with full data and recommendations without any cost or obligation.

TYPICAL INDUCTION HEATING APPLICATIONS



A Lepel installation at Federal Telephone and Radio Co. shown soldering transformer terminals. A precision operation made so simple that even unskilled operators can achieve excellent results on a production basis.



The simultaneous soldering of a group of components within one load coil is an ideal application for induction heating. The assemblies consist of mounting studs and tubes inserted into a machined part together with preformed solder rings. The heating is done so rapidly that there is practically no scaling or discoloration.

Electronic Tube Generators—1 KW; 2½KW; 5 KW; 10 KW; 20 KW; 30 KW; 50 KW; 75 KW; 100 KW.
Spark Gap Converters 2 KW; 4 KW; 7½ KW; 15 KW; 30 KW.

WRITE FOR THE NEW LEPEL CATALOG . . . 36 illustrated pages packed with valuable information.

All Lepel equipment is certified to comply with the requirements of the Federal Communications Commission.

LEPEL HIGH FREQUENCY LABORATORIES, INC.
55th STREET and 37th AVENUE, WOODSIDE 77, NEW YORK CITY, N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-172

erates over a 36-sq ft area without resetting the material. Because of indexing controls, there is no need for layout and drill jigs.

The machine is designed to utilize single-flute gun drills, with provisions for a coolant-wash combination. This feature permits continuous penetration without retraction for clearing chips. Diameter tolerance of ± 0.001 in., and #6 microfinish is possible with the proper feed.

Drill spindle speed is adjustable within a range of 300 to 5000 rpm.

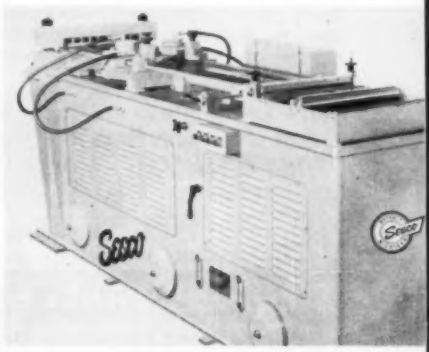
The drill spindle operates within a six by six-foot horizontal-vertical range. Drill bushing adjusts from zero to 12 in. longitudinally.

The Lahr Machine & Tool Corp., 3400 Maplewood Ave., Toledo 10, Ohio.

T-12-1721

Pressroom Equipment

Basically a combination feed and blanker unit, the Sesco-Matic, is comprised of three sections incorporated in a single unit. First section of the unit contains the lubricator and lubricant tanks. It submerges the stock, lubricates it on both sides and removes excess lubricant. Proper level of lu-



bricant is always maintained automatically. In the second section is a built-in hydraulic double-gripper feed. A stroke adjuster permits change of distance between two pistons to obtain exact duplication of stroke length and assures feed within 0.003 in. of the selected setting.

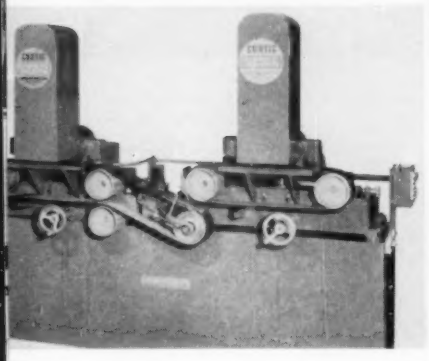
The third section of the unit is a precision cutoff which is sequenced with the feed cycle. Blanks are cut off with minimum stock waste and are ready for feeding into die presses.

The unit is so designed that there is no danger of scuffing or scratching stock during handling.

Sesco Inc., 8881 Central Ave., Detroit 4, Mich. **T-12-1731**

Abrasive Belt Grinder

Model 304C2 abrasive-belt grinder, grinds, polishes or deburrs both surfaces of a workpiece in one handling. This is accomplished by twin heads, two parts conveyors and a turnover unit



between the heads. The equipment can be adjusted for different sizes and shapes of parts.

It uses abrasive belts 4 in. wide x 54 in. long. Optional equipment includes additional tandem heads, wet grinding, oil mist, hold-down rolls and magnetic clutches.

Curtis Machine Corp., Jamestown, N. Y. **T-12-1732**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Duplicator Table

This duplicator table incorporates an adjustable friction brake, which allows the operator, by turning a simple adjusting screw, to select the sensitivity desired for each milling operation. It also has circular ball-bearing raceways on both longitudinal and cross travel slides for smooth table movement.

The unit is available with overarm to fit the Bridgeport ram type machine, as well as the round overarm type machine.

Incorporation of the brake, together with the improved raceway design, enables the users to do intricate three-dimensional milling on such products as punches, dies and plastic molds of all types. Heavy work, such as the profile milling of intricate shapes on a production basis, can be accomplished with unskilled operators.

J. M. Kalins & Co., 1575 Railroad Ave., Bridgeport, Conn. **T-12-1733**

Drop Forging Hammer

Piston-lift gravity drop forging hammer, called the Rigidrop, is designed so its operator has complete control of stroke length by varying pressure on the hammer's treadle. The units, available in sizes from 1500 through 5000 lb, are designed for rapid operation.

A special arrangement provides 40 percent more guiding surface on the ram, for guiding accuracy and constant maintenance of die adjustment. Ram of the Rigidrop can be removed from the

the new concept of vertical measurement is here
Webber Micro-Accurate
OPTICAL HEIGHT GAGE
This revolutionary new instrument will make micro measurements in the 1" to 61" range with an hitherto unknown overall accuracy of ± .000005" per inch.
These fantastic measurements are made speedily and easily by the average skilled workman.
Next to your Gage Blocks the new Webber Optical Height Gage will be the most useful tool in your shop. There is nothing like it in all the world.
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Webber Micro-Accurate Gages
LARGEST EXCLUSIVE MANUFACTURER
OF PRECISION GAGE BLOCKS

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AIRengineering at work
REPORT No. 5098B-3

Multiple Screw Driver assembles 400 carburetors per hour

Assembling carburetors was a slow, one-screw-at-a-time operation until AIR engineering solved the bottleneck. Now one operator uses this 8-spindle automatic Multiple Screw Driver to help turn out more than 6 completed carburetors per minute—400 every hour.

This compact, easy-to-operate Multiple Screw Driver is just one more example of how AIR engineering is helping modern industry solve problems and cut production time and costs.

All the experience of Ingersoll-Rand in speeding up fastening through AIR engineering multiple units is yours for the asking. Whether your operations involve screw-driving or nut running with either hand-held or automatic production line units, Ingersoll-Rand can engineer and build just the unit best suited to your needs.

8-Spindle Multiple Screw Driver for carburetor assembly.

Drop us a line if you'd like an AIR engineer to analyze and make recommendations on your fastening operations.

Ingersoll-Rand

8-341

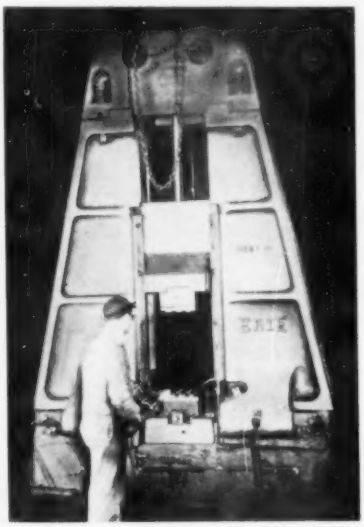
11 Broadway, New York 4, N.Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-174

hammer at die level, without jacking.

Designed for maximum safety, there are no loose linkages or overhanging parts. As with Erie steam drop hammers, a cushion head affords protection if the hammer is overstroked.

Features contributing to easy opera-



tion include a built-in inching mechanism for die setups, and the clamping system. Clamp faces are set directly opposite one another to provide positive clamping action without bending the rod.

Erie Foundry Co., Erie, Pa.

T-12-1741

Radius Cutting Machine

Radii may be cut in a few seconds with this radius cutting machine. Ease of operation and simple adjustments allow machine to be operated by unskilled labor.

This specialized milling machine is

designed to cut a radius on square, rectangular, flat or round material, ferrous and nonferrous metals, of any size up to 1¼ in. thick by 2½ in. wide.

The unit, designated Radii II, requires no setup time. A blower draws chips through a hollow spindle housing and ejects them through a chute into chip pan at rear of machine.

Special Machinery Co., Inc., 49 Springfield St., Chicopee, Mass. **T-12-1751**

Ram Type Manipulator

This line of automatic ram type welding head manipulators has been modified so that both ram travel and travel of entire unit on track are controlled by electronic adjustable speed drive unit to provide speed range from 5 to 100 ipm or any desired 20:1 ratio.

Dynamic braking stops ram instantly. Vertical movement of the ram is by motorized double chain lift, plus counterweight in column and brake motor. Ram deflection and sideways deviation is minimized.

There is easy manual rotation of 360 deg.

C. B. Herrick Mfg. Corp., 2000 Center St., Cleveland, Ohio. **T-12-1752**

Narrow Strip Mill

Both ferrous and nonferrous materials can be processed by this reversing cold strip mill designated Model TAL-625. The unit is specifically designed to fulfill moderate output requirements in the production of close-tolerance and thin-gage strip up to 8 in. wide. The mill operates at speeds up to 500 fpm and holds thickness tolerances as close as ± 0.0001 in. consistently.

The backup drive permits rapid roll changing as well as allowing change in

Have you seen what this CAN DO FOR YOU?

Torque control IMPACTOOL

NEW accuracy and speed for precision nut running jobs...

- **POSITIVE TORQUE CONTROL**—a revolutionary use of a rugged steel torsion bar for precision control of torque—combined with the power and speed of the Impactool.
- **SIMPLE TORQUE SETTING**—torsion bar adjusting sleeve is clearly calibrated for changing torque with easy-to-use torque jig.
- **TORQUE SETTING REMAINS CONSTANT**—for any nut running condition until the adjustment is changed.
- **ELIMINATES "OVER-TORQUE"**—impact mechanism rebounds instantly when preset torque is reached, tripping a foolproof rubber faced shutoff valve.
- **LOW MAINTENANCE**—combines many of the proven features of Ingersoll-Rand Impactools, with their enviable record of dependable performance and low maintenance.
- **REVERSIBLE**—full power in either direction.
- **NO CLUTCH**—to wear, slip or require adjustments.

* 2 TORSION BARS PROVIDE MULTIPLE TORQUE SETTINGS

- No. L735 Max. torque 60 ft. lbs.
- No. H735 Max. torque 90 ft. lbs.

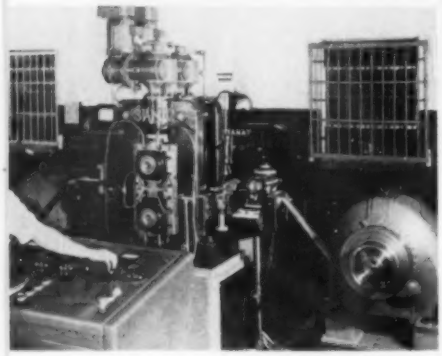
For torques up to 550 ft. lbs. a Size 5340T Torque Control Impactool is available.

Get a free demonstration of Ingersoll-Rand Torque Control Impactools by an I-R AIR engineer now... or write for additional information.

Ingersoll-Rand
11 Broadway, New York 4, N.Y.
8-342 IMPACTOOL DIVISION
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-175

work roll diam without affecting linear rolling speed of the mill. To handle a 0.125 to 0.001-in. range of strip, work rolls from 2½ down to ¾-in. diameter can be employed.

Backup rolls are 8-in. diam; work rolls are 2½-in. diam (max); and both



are available in either an 8 or 10-in. face width. Roll wipers and run-in and runout tables, equipped with adjustable side guides, are provided on the machine.

Roll frames are constructed so they are capable of taking loads in excess of usual requirements with minimum deflection, and are designed so that there are no roll marks.

Radial loads are taken by heavy-duty needle roller bearings, equipped with bronze cages, and axial movement is controlled by ball thrust bearings. Backup roll bearings have a maximum separating load capacity of 150,000 lb.

Stanat Mfg. Co., Inc., 47-28 37th St., Long Island City 1, N. Y. **T-12-1761**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Arbor Presses

Line of heavy-duty, Vi-Speed air arbor presses is available in 16 models, ranging from 1 to 5 tons, either hand or foot controlled. The units have up to 6¾-in. throat clearance with adjustable ram clearance up to 12 in. Any stroke is allowable from a minimum of 2 in. to the maximum ram clearance. The presses are suitable for use in riveting, forming, bending, press-fitting, etc. Units up to 2 tons have 1½-in. OD rams; larger units have 2-in. OD rams. Most rams are keyed for nonrotation.

Base dimensions of the press are kept at a minimum by stacking cylinders of

similar bore sizes to increase the power thrust. On double-acting stacked cylinders, only one cylinder is used for the return stroke which permits 25 percent saving in air consumption.

Van Products Co., 5789 Old Ridge Rd., Erie 7, Pa. **T-12-1762**

ETALON INGAGE

measures the *exact* BORE

or blind hole size!

Reading: .0001"
Sizes: 3/16" to 1.6"

Takes accurate measurements of blind holes. No masters or setting rings—measures *directly*—by .0001".
Automatic alignment, rectangular contact points guarantee extreme accuracy even when fully extended. Immediately detects out of round holes; with extensions measures holes up to 6 feet deep. Hardened contact points exert only 11 oz. pressure—will not damage fragile work.
Easy to read, deep graduations on a large diameter thimble. Dull chrome plated. Furnished in English or Metric graduations, individually or in sets.

WRITE FOR CATALOG on complete line of precision measuring instruments:
VERNIER CALIPERS
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DIAL INDICATORS

ALINA

ALINA CORPORATION
401 Broadway, New York 13

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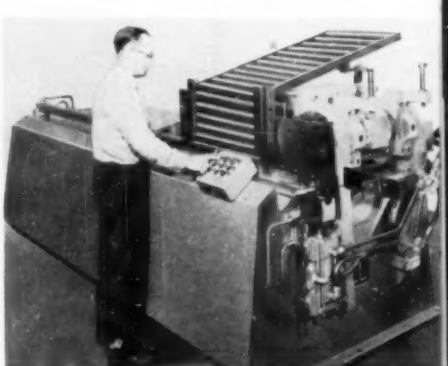
Automatic Bending Machine

Magazine-fed, heavy-duty, high-speed automatic tube bending machine will bend 2 in. diam steel tubes 90 deg in a 4-sec. bending cycle without any operator handling. It provides an automatic means of bending tubing up to 2-in. diam to angles up to 180 deg. On bends with short legs the machine will operate continuously, and automatically eject parts. A single-rotation, hydraulic actuator provides smooth, continuous power.

The machine illustrated makes 30, 45 or 90-deg bends in 2 in. diam steel



gasoline tank filler necks in a 4-sec. bending cycle at a net production cycle of 650 parts per hour.

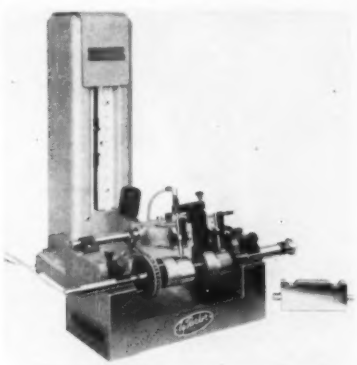
The hydraulic system includes 40-gpm, 1000-psi, high-volume adjustable-flow pump, powered by a 30-hp motor which operates the die table; and a 5-gpm, 2000-psi, low-pressure, low-volume, positive-displacement pump powered by a 5-hp motor that is used for clamping.

Walter P. Hill, 22184 Telegraph Rd., Detroit 19, Mich. **T-12-1771**

Cam Inspection Device

Cams can be checked as much as ten times faster than is possible with conventional methods, using this 3-D Comparitor. This device gives readings that are accurate to tolerances of ± 0.0002 in., and measurements of ± 0.0001 in. are possible on high precision work.

With the 3-D Comparitor, it is also possible to make complete comparison



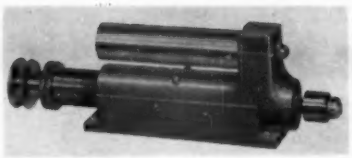
of any two or three-dimensional cam. It gives true readings on any number of specified points and also measures any number of points between stations, compared with a master. It is possible to inspect 50 to 60 cams per day. An intricate three-dimensional cam with 4000 stations may be checked in less than 4 minutes.

Parker Stamp Works Inc., 650 Franklin Ave., Hartford, Conn.
T-12-1772

Floating Spindle Drill

Sturdy, low-cost air feed floating spindle unit for drilling, reaming, countersinking, and other machine operations is available for applications where hydraulic feed and accurately controlled speed rates are not essential.

The quill is suspended on ball bearings at 11-in. centers within a 1½-in. diameter quill body. Base frame is 7 in. long with 3 in. at each end and 1-in. well in center for grease chamber. The unit can be operated at high speeds.



Sides and bottom are machined to close tolerances square and parallel to the spindle to simplify alignment of drilling unit on single or multiple set-ups.

It is equipped with a ¼-in. capacity chuck. Stroke is adjustable to maximum of 2 in. with 2-in. centers.

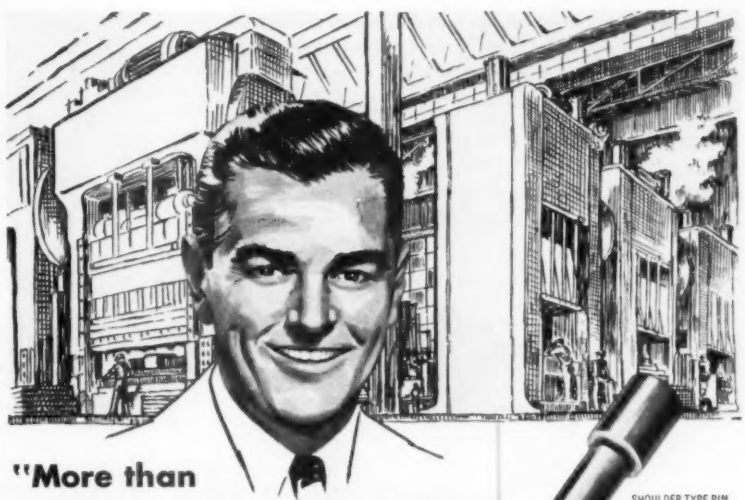
Distributed by Burklyn Co., 3429 Glendale Blvd., Los Angeles 39, Calif.
T-12-1773

Cylindrical Grinders

A line of heavy-duty cylindrical grinders, 14-in. Type C-2 and 18-in. Type LC-2, are designed to handle, on centers, workpieces weighing up to 6500 lb. The machines are available as plain grinders or semiautomatics.

Controls for feeds and speeds are located on the front of the machine at the operator's position. The combination graduated wheel feed handwheel continually indicates amount of infeed as the wheel rotates past a fixed pointer, while a click-count indexing mechanism permits settings in increments of 0.00005 in. quickly and without visual attention.

Other features are preset table truing and grinding speed arrangements. Table



"More than
TWENTY MILLION HITS
since we changed to Lamina Guide Pins and Bushings!"

"Since changing to Lamina Guide Pins and Bronze-plated Bushings on our dies, they have run more than 20,000,000 hits . . . and they're still going! Formerly, the best we could get was 4,000,000 to 5,000,000 hits on any make." *This is a typical quotation from an actual user letter.*

Lamina bronze-plated wring-fit bushings are pre-finished on the I.D. Seated on a shoulder square with the die shoe surface and secured by special retainers, they assure distortion-free, full bearing surface that results in better die alignment, less maintenance and longer die life.

Lamina Guide Pins are special tool steel, heat treated, spray quenched, hardened, ground and burnished. The uniform, hard surface resists wear, while the tough core won't bend in installation or use. These dimensionally accurate pins do not "mushroom" or get out of round, and require no "running in."

There is a size and type Lamina Guide Pin and Bushing for every need. Our new catalog shows illustrations, applications, dimensions and prices of more than 800 items. Ask your die set supplier, or write us for your free copy now.

SHOULDER TYPE PIN. 1" to 4½" diameter. Straight and Removable types also available.

LONG SHOULDER Bronze Plated Bushing contains pin during entire stroke. ¾" to 3" I.D.

NUT TYPE Bronze Plated Bushing for wide range of requirements. 1" to 2" I.D.

Lamina
DIES AND TOOLS, INC.
P.O. BOX 31, ROYAL OAK, MICHIGAN

SPECIAL PINS AND BRONZE-PLATED BUSHINGS for any application . . . tailored to your requirements. Send prints for prompt quotation.

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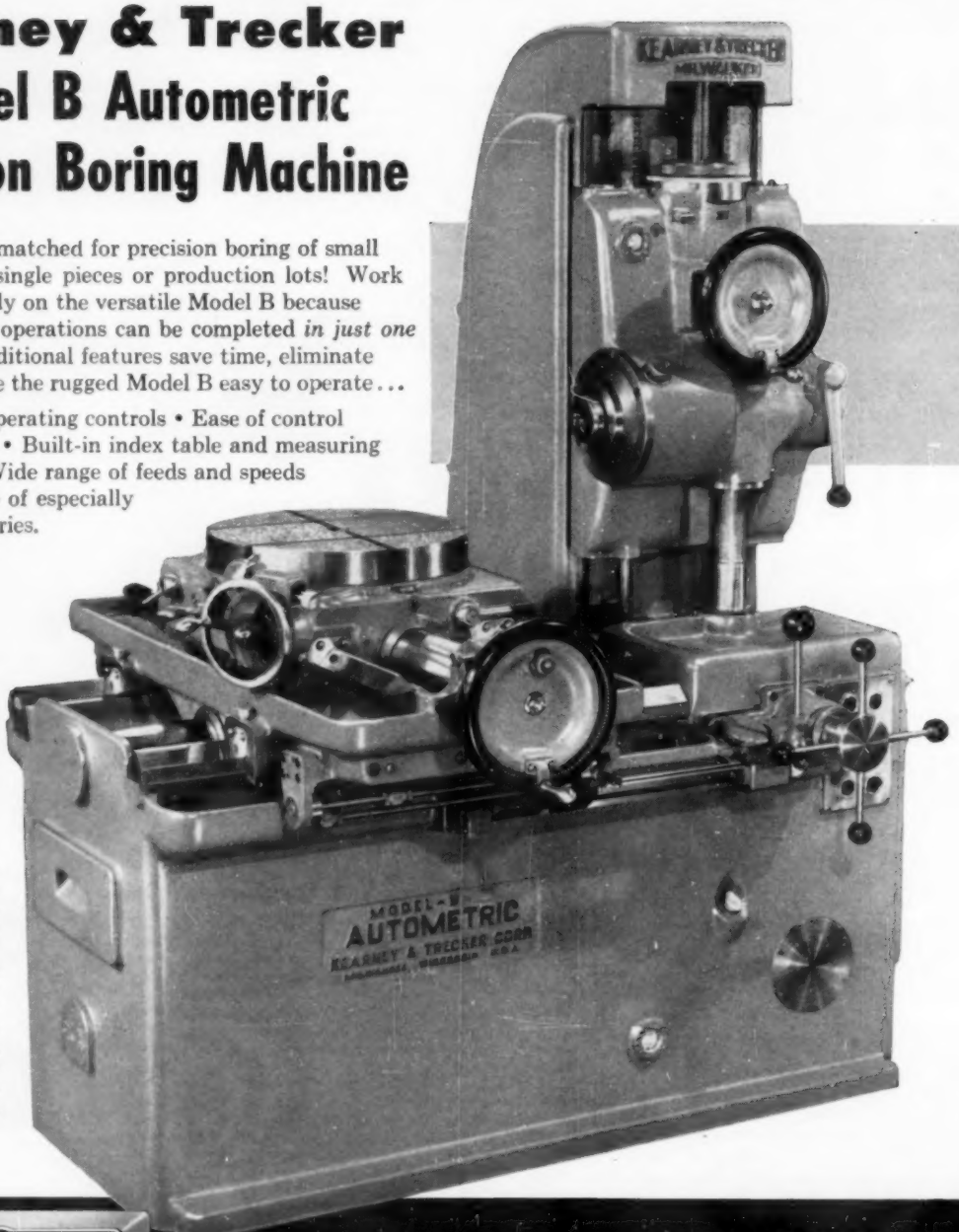
Speed Precision Boring

and maintain accuracy of .0002" in 12" with the

Kearney & Trecker Model B Autometric Precision Boring Machine

Here it is . . . unmatched for precision boring of small work . . . either single pieces or production lots! Work progresses rapidly on the versatile Model B because multiple boring operations can be completed *in just one setup.* These additional features save time, eliminate errors, and make the rugged Model B easy to operate . . .

Convenient operating controls • Ease of control • Ease of setup • Built-in index table and measuring instruments • Wide range of feeds and speeds • Complete line of especially selected accessories.



Model B Autometric: 16" dia. table; 10" Vert. Travel; 16" Transverse Travel; 15" Carriage Travel; 8 speed changes—.0005" to .0148" per Spindle rev.; 50 to 2500 rpm. For complete details, ask for Catalog No. BMA-10.

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SAN FRANCISCO, CAL.
Moore Machinery Co.
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Moore Machinery Co.
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Dawson Mach. Co.
5700 First Ave., S.

SHREVEPORT, LA.
Peerless Supply Co., Inc.
701 Spring St.

SYRACUSE 1, N. Y.
Syracuse Supply Co.
314-332 W. Fayette St.

TULSA, OKLA.
White Star Mach. Co.
104 Boulder Bldg.
19 West 10th Street

WICHITA, KAN.
White Star Mach. Co.
301 N. St. Francis

CANADA

MONTREAL
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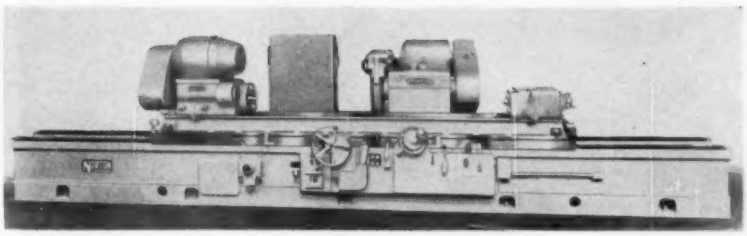
Williams & Wilson Ltd.

KEARNEY & TRECKER MILWAUKEE



speeds for truing and grinding are independently adjustable and preset. Either speed is obtained thereafter by movement of a combination selector and table start-stop lever.

The units have a centrally located work-jogging lever, automatic or manual control of work rotation and coolant flow, automatic adjustable wheel feed at table reversals with automatic wheel head resetting, and separate dwell controls for each end of table reversal.

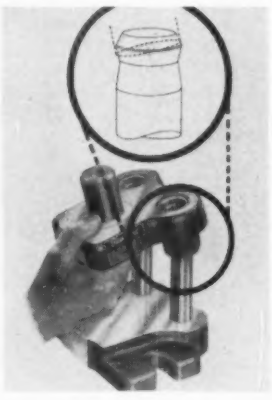
Table drive by hydraulic power is available from 2 to 240 ipm.

Norton Co., Worcester 6, Mass.

T-12-1791

Die Set Post

This McVey Post®, designed to avoid jamming or binding during assembly of precision die sets, has a ground taper lead which automatically guides the die set punch holder into the correct mounting position without hammering or tapping. A special "controlled width" land of the same diameter as the post provides a pivot plane for the punch holder bushing. This feature assures quick, automatic alignment and long wear. The units, which are available for both 2 and 4-post die sets, provide good die set performance and assembly ease.



Standard Die Set Manufacturers, Inc., Elmwood Ave., Providence 7, R. I.

T-12-1792

Machinery Roller

The Express Roller, designed to move heavy machinery or equipment, comprises two main components: a series of moving rollers locked in an endless track and extending above and below the bottom of a heavy steel frame. The frame, which has serrated edges, grips and carries the work load. The roller is available in five ranges of sizes, from 2 to 150-ton capacities, straight compression force.

Available accessories include a revolving base plate mounted on ball bearings which locks onto the roller chassis, permitting easy turning of the load. An optional handle locks onto the plate.

Express Roller Div., Industrial East Co., P. O. Box 561, Clifton, N. J.

T-12-1793

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

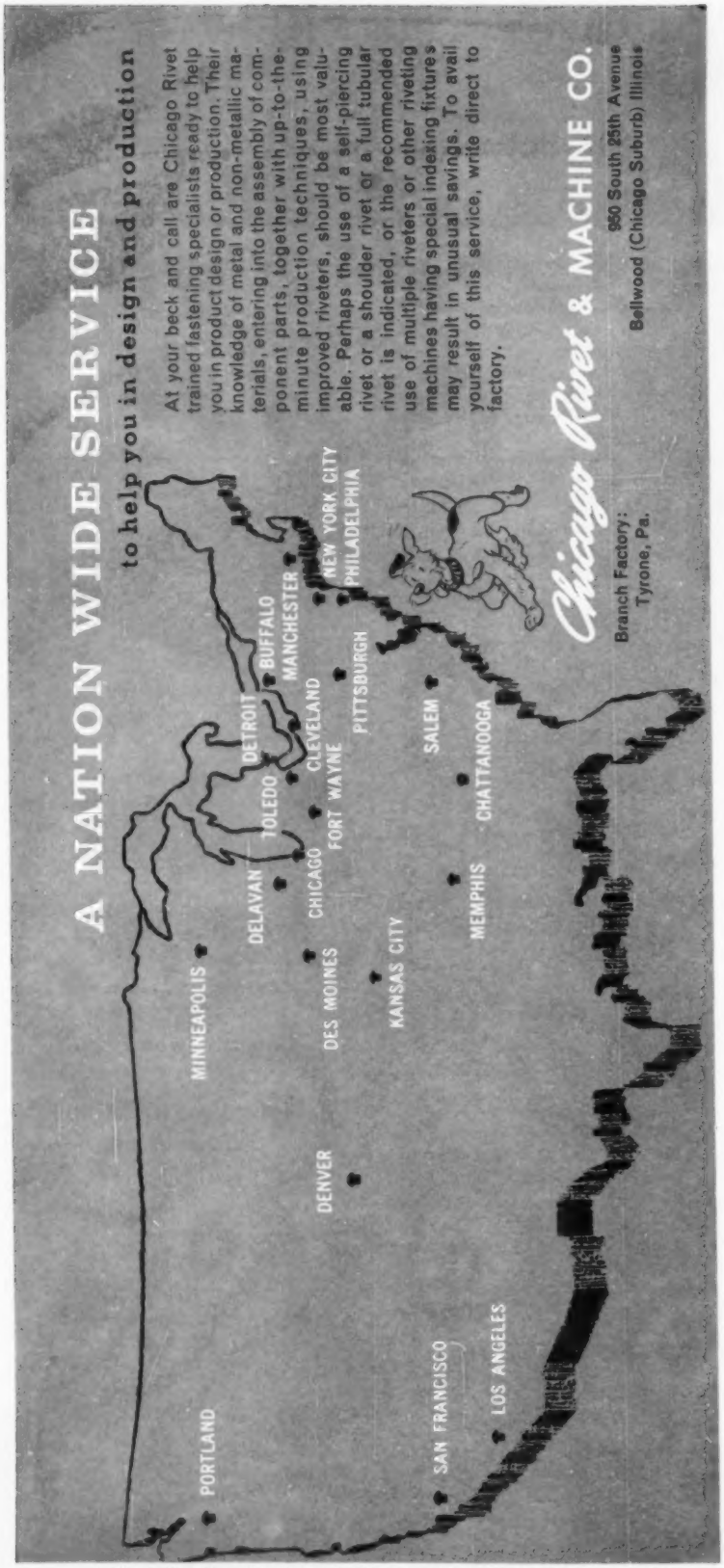
Cool Grinding Attachment

Cool grinding attachment is designed to permit the entire unit to be located on the grinder.

Air is supplied from the shop air system by attaching a hose to the snap-on air connection at the rear of the unit. Coolant is stored in a 2½-gal vertical tank, which has a transparent faceplate to permit view of the coolant level.

Component parts on the air line consist of a water-filter trap, diaphragm type pressure regulating valve (manually controlled for the desired fineness of spray), and an air gage. Operating air pressures are between 5 and 80 psi, depending on the spray.

Spray nozzle is designed to provide a fine spray pattern, and excess spray evaporates. Direction of the spray is easily adjustable, and can be applied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At your beck and call are Chicago Rivet trained fastening specialists ready to help you in product design or production. Their knowledge of metal and non-metallic materials, entering into the assembly of component parts, together with up-to-the-minute production techniques, using improved riveters, should be most valuable. Perhaps the use of a self-piercing rivet or a shoulder rivet or a full tubular rivet is indicated, or the recommended use of multiple riveters or other riveting machines having special indexing fixtures may result in unusual savings. To avail yourself of this service, write direct to factory.
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TOLEDO
DETROIT
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NEW YORK CITY
PHILADELPHIA
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SALEM
CHATTANOOGA
MEMPHIS
FOR FURTHER INFORMATION USE READER SERVICE CARD; INDICATE A-12-180

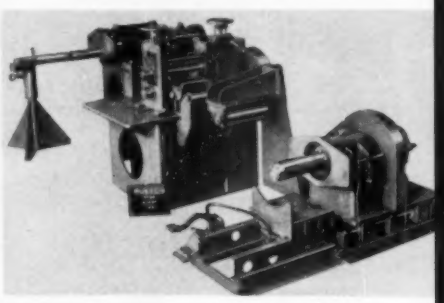
exactly at the point-of-contact of wheel and workpiece. Coolant does not flow over the work, and there is no need for splash guards or a flow-back settling tank.

Any commercial coolant, soluble in water, maybe used with the cool grinding attachment.

Reid Brothers Co., Elliott St., Beverly, Mass. **T-12-1801**

Slitters

Materials ranging from ultrathin gages up to ¼ in. in ferrous and nonferrous metals are handled on these slitter lines which provide accurate, close-tolerance strip widths. These slitters, operating at up to 1000 fpm, con-



trol the material width at the cutting point.

A pay-off device limits the amount of waste edge-cut; salvage is minimized. The pay-off adjusts during the run of material to hold a uniform edge-cut.

Suitable rewind equipment and other accessories also available with the slitter lines to fill special needs.

H. J. Ruesch Machine Co., 407 Mulberry St., Newark 2, N. J. **T-12-1802**

Printed Circuit Punching Machine

Model 10-AA Fabricator, specially redesigned for punching printed circuit boards, employs a pantograph-principle accessory called the Positive Duplicator, and reproduces any pattern of holes up to 15 x 25-in. area from a master template. Holes of any shape from 0.030 to 3½ in. in diam can be punched cold in most dielectric materials. Close-fitting guides, which accurately align the punch tip with the die, assure absence of cracks, halos or bell-mouth.

Master templates can be punched out in the desired pattern and with standard ⅛-in. pilot holes by reversing the process with this machine. Steel templates up to ¼ in. thick are easily punched by this 20-ton press.

The press reciprocates at 165 spm

and can be tripped at highest operator ability. Punch changes, in sizes up to 1¼ in. in diameter, are made in 15 seconds.

Wales-Strippit Co., North Tonawanda, N. Y. **T-12-1811**

Drill Press Positioner

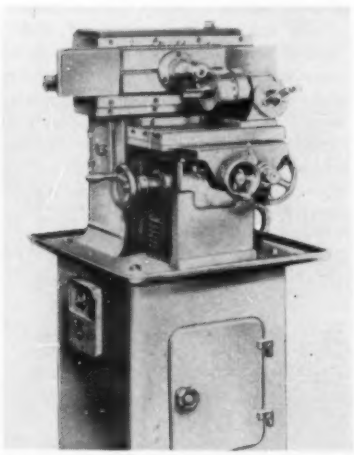
With this drill press positioner, holes can be drilled or center-drilled to a tolerance of 0.001 in. in a few seconds. It is not necessary to lay out, prick-punch or check locations for the drilled holes. Work may be drilled in place or removed to a drill press. Holes may be spotted in 0.001-in. intervals up to 12-in. distance for the X axis and 6-in. for the Y axis.

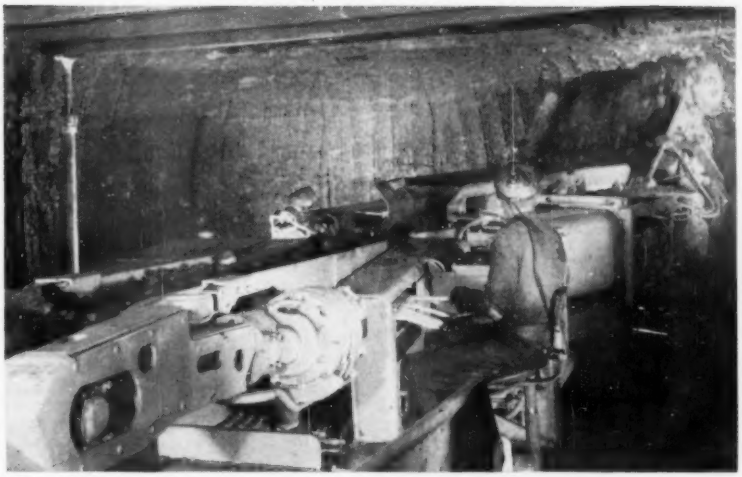
Adjustments for wear or damage may be made quickly and easily.

Bayer Industries, Phoenix, Ariz.
T-12-1812

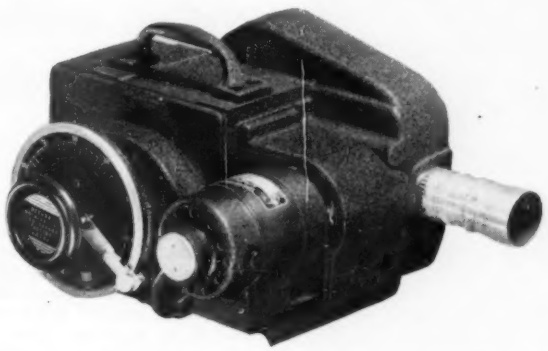
Punch Shaper

This K-150 form and punch shaper produces high-precision close-tolerance punches with curved necks. Punches need no further machining operations when completed on the K-150. Work-





This is a continuous coal miner in operation. Its maker, Joy Manufacturing Company, wanted to know how the cutter bits performed when cutting coal and pyrites. But the bits moved too fast to see.



This is a Kodak High Speed Camera. Joy engineers took it down in the company's coal mine laboratory and used it to take 16mm movies of the cutter bits in action at speeds up to 3200 frames a second.

When they projected the movies at a normal 16 frames per second, the action was slowed as much as 200 times on the screen. Then they could see the action of the cutter bits at different angles and positions in the holding chain, determine the best possible arrangement for maximum cutting efficiency.

The Kodak High Speed Camera is a practical instrument for practical engineers who would rather see what's happening than waste time guessing. The booklet "High Speed Motion Pictures at the Service of the Engineer" will give you both information and ideas. For your copy write:

EASTMAN KODAK COMPANY, Rochester 4, N.Y.

the Kodak
***HIGH SPEED* Camera**

Kodak
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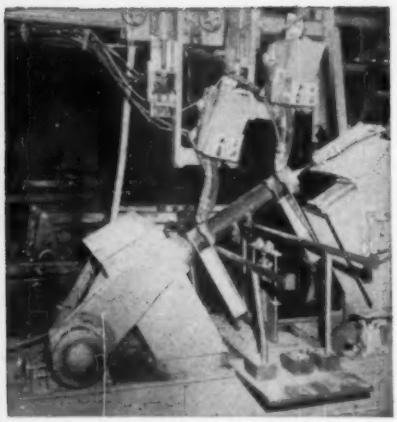
When a line of automatic welders for AC or DC operation

Has the most sensitive controls for fast starting and uniform welds

Yet is easiest to adapt to any fixture

WHY buy anything but LINCOLNWELD for automatic welding



Automatic Lincolnweld *producing 2 hidden arc girth welds simultaneously for welded assembly of automotive components.*

Makes assembly operations simple with Automatic Lincolnweld

HERE two girth welds are made simply and quickly by using Automatic Lincolnweld heads . . . at speeds of 30 inches per minute. The assembly of the arms to the tube is first tack welded and then loaded between centers. The Lincolnweld heads are lowered by air plungers and the welding cycle started. The weld is completed in a single pass using Lincoln L-60 mild steel electrode wire and Lincoln 780 Agglomerated Flux.

Cost reductions are possible on virtually all types of fabrications with Automatic Lincolnweld.

Three types of Lincolnwelds are available: LAF-3 and LAF-5 for DC welding, LAF-4 for AC welding. Write for Bulletin 1355 for complete data on Automatic Lincolnweld.

THE LINCOLN ELECTRIC COMPANY
Cleveland 17, Ohio
The World's Largest Manufacturer of Arc Welding Equipment

THE LINCOLN ELECTRIC CO.
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Cleveland 17, Ohio

☐ Send me Bulletin 1355 on Automatic Lincolnweld.
☐ Have representative call.

Company_____
Address_____
City_____ State_____
Name_____
Position_____

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pieces are clamped directly in a collet holder, between centers or to the coordinate chuck. Coordinate chuck and indexing attachment guide the workpiece along the contour with a single chucking.

All machining operations can be checked during the shaping process with the special built-in 30-power microscope.

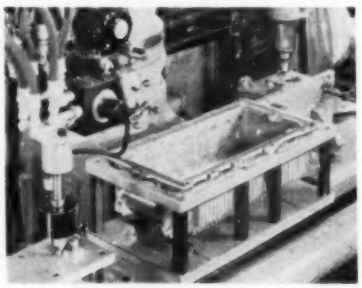
Jersey Mfg. Co., 455 Livingston St., Elizabeth, N. J. **T-12-1821**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Tracer Control System

The tracer of this system, which is adaptable to any standard milling machine is a magnetic sensing type stylus by which a closed 2-dimensional contour is reproduced automatically. Operator control involves only predetermining maximum feed rates. The tracer is adjustable and feed speed range will remain constant along any 360-deg contour during tracing operations.

Tracer control movements to saddle and table are through hydraulic cylinders replacing the machine's present



feed screws on table and saddle. Tracer valve is mounted in a vertical plane in direct relation to and parallel with the axis of the vertical spindle. The tracer is mounted on a swivel type overarm.

The tracer valve, equipped with a built-in selector, can be used as an automatic 360-deg pencil type tracer control, allowing pockets of a predetermined depth to be machined, using an oversized tracer stylus under hand control and finishing the periphery of the pocket utilizing the automatic 360-deg control feature.

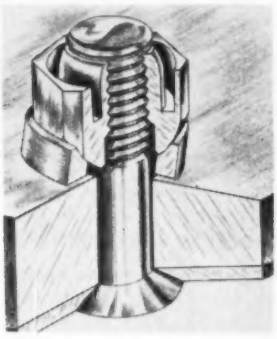
Turchan Follower Machine Co., 8259 Livernois Ave., Detroit 4, Mich. **T-12-1822**

Self-Aligning Locknut

Nonparallel surfaces may be fastened with these counterbored, self-aligning, hexagon locknuts, identified Type LH2935. The nut, which has a base with

a convex seat which mates with an alloy steel concave seat washer, tilts 8 deg in any direction from center line to compensate for angular misalignment of fastening surfaces. Washer base is manufactured to withstand high bursting pressures. Tightening the bolt in the normal manner automatically seats the nut in the base and adjusts it to the proper angle.

LH2935 parts are adaptable to either short or long thread bolts by the in-



corporation of a counterbore in the nuts.

The self-locking device provides positive protection against the nut loosening due to vibration, and offers extended reusability. Performance is to AN-N-10 and/or MIL-N-25027 (ASG) specifications for temperatures up to 550 F.

Currently available thread sizes are 10-32, ¼-28 and 5/16-24.

Elastic Stop Nut Corp. of America, Union, N. J. **T-12-1831**

Ignitron Tube

An improved ignitron tube, Type WL-5822-A, for control of frequency-changer resistance welders, directly replaces the WL-5822. It is a sealed, stainless-steel jacketed, water-cooled, mercury-pool tube capable of intermittent ignitor service. Maximum anode voltage rating is 1200 or 1500 v at 1500 or 1200 amp.

It features a provision for thermostatic control, which when equipped with suitable thermostatic switches, conserves cooling water consumption and simultaneously protects the tube and associated equipment from overloads and overheating.

Over-all length including leads is 25 in. and the diameter is 4¼ in. The unit weighs only 8¼ lb.

Westinghouse Electronic Tube Div., Box 284, Elmira, N. Y. **T-12-1832**

Contour and Surface Projector

Self-contained portable projection magnifier is suited for simple, efficient inspection and examination of relatively flat objects and small parts, imprinted circuits, fine print of small scale drawings and like applications. Two models are available; one enlarges the original material 3 times; the other, 5 times. The unit, called the Magnavisa, can be used for prolonged periods without eyestrain in any normally lighted area.

The magnified image is projected onto a uniformly illuminated 4½ x 12-in. viewing screen. Additional areas of the object can be examined by moving the platform in the desired directions.

Movements of the magnified image on the viewing screen appear in the same directions as the object.

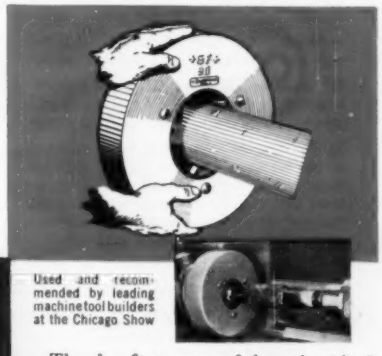
Over-all size of the projecter is 21⅛ x 13¼ x 13¼ in.; throat opening is 3⅞ in.

American Optical, Instrument Div., Buffalo 5, N. Y. **T-12-1833**

Micrometers with Interchangeable Anvils

A wide variety of measurements may be obtained with these micrometers which feature multiple interchangeable anvils. Two anvils are furnished: a rod anvil approximately 0.120 in. in diam, for measuring from a hole to an edge; a flat anvil, 0.125 and 0.060 in. thick

SKINNER
+GF+
WORK DRIVERS



Used and recommended by leading machine tool builders at the Chicago Show

...the best for turning on centers!

They're fast, powerful — the ideal means for driving smooth or rough bars and forgings located on centers! Jaws are easily reversed to accommodate direction of spindle rotation. Five sizes handle work from ¼" to 8 1/16" diameter.

• ½ turn does the clamping — no wrenches needed
• Each size has wide clamping range • Cuts clamping and unclamping time • Clamps out-of-round work evenly
• Clamping force always matches cutting pressure.

Write Skinner or your Skinner distributor for folder.

THE CREST OF QUALITY

THE SKINNER CHUCK COMPANY
206 Edgewood Ave., New Britain, Conn.

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Now! Closer gage block tolerances give you up to 75% longer wear life at no increase in price!

Ellstrom Standards are now produced and unconditionally guaranteed to specified millionths well within the following improved gage block tolerances:

"W" Working Accuracy Blocks: +.000008", −.000002" per inch of length, with flatness and parallelism held within .000006".

"I" Inspection Accuracy Blocks: +.000004", −.000002" per inch of length, with flatness and parallelism held within .000004".

In addition to providing finer accuracy at no increase in price, these Ellstrom Standards also give you up to 75% longer wear life. For, by reducing the allowable "minus" deviation, you get an additional guaranteed wear allowance of from 2 to 6 millionths of an inch, as compared to common industry standards, before the blocks need be considered worn undersize.

Ellstrom Standards are furnished in 28 basic sets of from 8 to 92 blocks in both rectangular and square styles. Individual blocks are also available in sizes ranging from .010" to and including 20.000" to meet your particular needs. Send for complete specifications and prices today!

Set No. 35-R: "W"—$195.80; "I"—$280.50

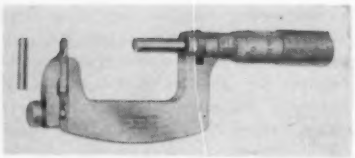
Set No. 81-SA: "W"—$545.60; "I"—$764.35

ELLSTROM STANDARDS DIVISION
DEARBORN GAGE COMPANY
"Measuring in Millionths for Three Generations"
22038 Beech Street • Dearborn, Michigan

REPRESENTATIVES IN PRINCIPAL CITIES THROUGHOUT THE UNITED STATES AND CANADA

- Ellstrom Internal Setting Gage—12" range: $185.00
- Ellstrom Rectangular Gage Block Accessory Set: $288.95
- Ellstrom Master Sine Bar "W" Accuracy: $112.50 "I" Accuracy: $152.75

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-184



at opposite ends, for measuring distances from the inside of slots and grooves to an edge.

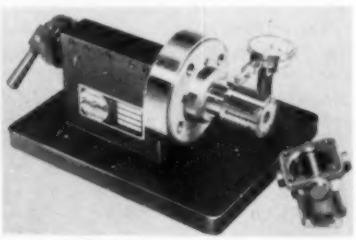
A vise type frame holds the interchangeable anvils. Change-over of anvils is quick and easy. The micrometer can also be used as a height gage by simply removing the clamping vise jaw.

The micrometer, called Mul-T-Anvil, is available in two sizes with ranges of 0 to 1 in. and 1 to 2 in. in thousandths of an inch.

The L. S. Starrett Co., Athol, Mass. **T-12-1841**

Inspection Fixture

This complete inspection fixture, comprised of all stock parts, combines Tork-Lok collet arbor and Zero spindle inspection fixture details to provide a



chucking tool for checking concentricity and/or squareness.

Interchangeable collet feature makes it possible to check a number of different parts on one fixture. Change-over is simple and quick.

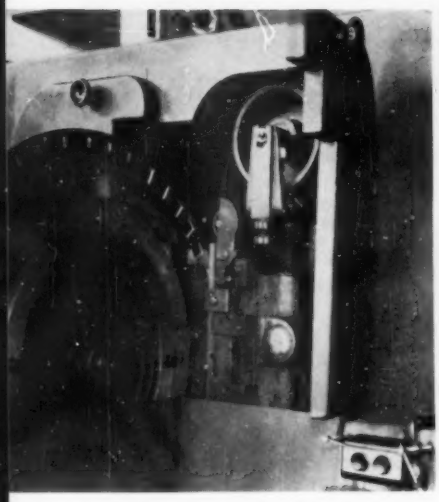
N. A. Woodworth Co., 1300 E. Nine Mile Rd., Detroit 20, Mich. **T-12-1842**

Twin Belt Surfacing Machine

Opposed abrasive belts are used as cutting media on this unit which accomplishes simultaneous operations, such as grinding, sanding, surface-polishing or deburring, on both ends of a part in a single pass. Each belt is backed by a hard or cushioned platen, depending on the work being handled.

Properly tooled, the machine may be used for a variety of applications where opposite sides of a part require a grinding or finishing operation.

The basic machine has been designed so that different types of work-feeding devices and conveyors may be attached. Each head is adjustable for parallelism



and is mounted on V-ways with easy adjusting facilities for work up to 6 in. wide. Belt size is 4 x 86 in.

Each head is powered by a 1200-rpm motor of 7½ hp, developing a belt speed of 3500 sfpm. The coolant system is self-contained and powered by a separate ¼-hp motor on the pump.

Production Machine Co., Greenfield, Mass. **T-12-1851**

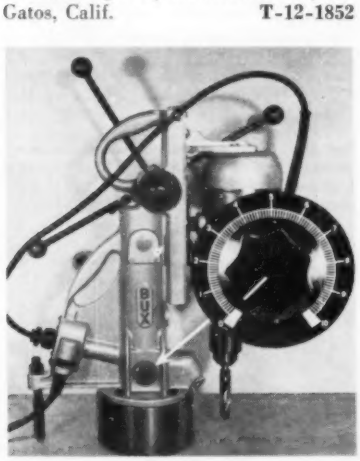
USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Electromagnetic Drill Press

Bux portable electromagnetic drill press, Model V-3, incorporates a rheostat control switch. This permits selection of the amount of magnetic pull needed for holding the drill while the operator is positioning and aligning it. Once the drill is positioned, full magnetic power holds the unit securely.

A pilot-light not only indicates "off" and "on" conditions, but is located to flood the drill point with light.

Buck Mfg. Co., 100 Roberts Rd., Los Gatos, Calif. **T-12-1852**



The WIEDEMANN METHOD *Cuts Piercing Costs* 60 to 90%

Because ONLY *a* WIEDEMANN *combines:*

A Punch Press
(PIERCING SPEED)

\+ **Punches and Dies in Turrets**
(NO SETUP)

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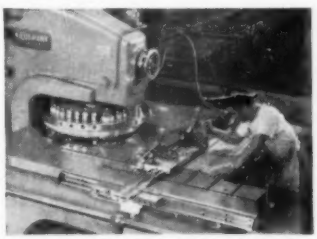
(NO LAYOUT)



Capacities from 7-½ to 150 Tons
Throat depths from 12″ to 60″

= ● INCREASED PRODUCTION
● REDUCED COST
● MAXIMUM FLEXIBILITY

Get the facts—send drawings of your work for a free time study or write for Bulletin 101.

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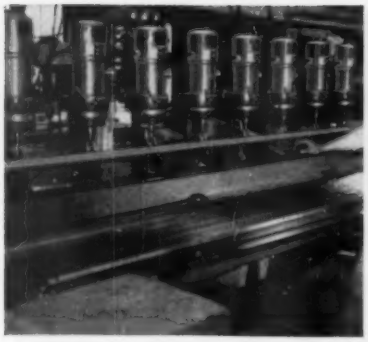


NEW Drill Set-Up Cuts 5-Day's Production to 5 Hours

Part of the production operation for the Western Patio Door Co., Berkley, California, is the drilling of eight holes in extruded aluminum sides for glass patio doors. By drilling one hole at a time and indexing the part eight times, 1200 pieces were produced in five eight-hour days. In an attempt to speed up this operation, and thereby cut costs, the set-up as shown was suggested.

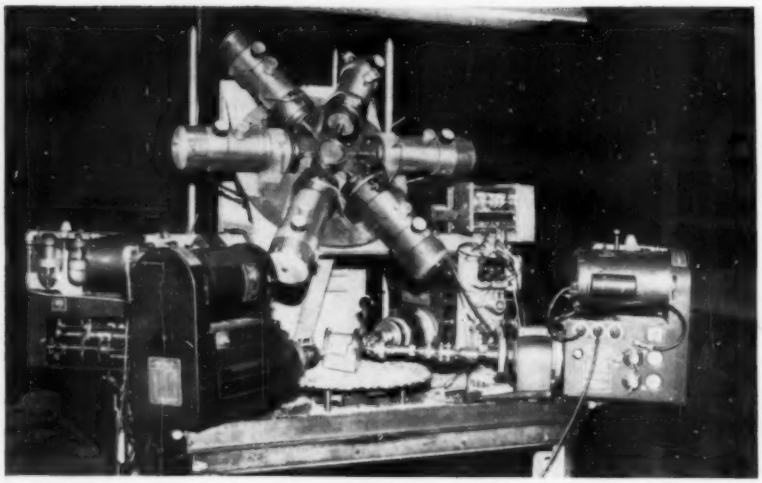
Set-Up

Now, the parts are fed to the operator on a slanted track-way under the new drilling machine. Pieces are then hand loaded and clamped into position. The operator actuates the machine by pressing one starter button. Eight heads with #38 drills then produce eight 3/16" blind holes in the part simultaneously in a matter of seconds.

This manufacturer now gets four of these parts drilled per minute. This includes loading, drilling, unloading and stacking finished parts. 1200 sides are completed in five hours, whereas it formerly required five eight-hour days. The time savings resulted in a substantial reduction in the production costs on this operation.

Drill Head Type

The drill head used for this unique machine is the Dumore Series 20 Automatic Drill Head. It utilizes the "resistance drilling" technique which permits the workpiece to determine the rate of drill feed and speed. Built-in controls practically eliminate drill breakage and scrap losses. It automatically maintains the correct feed pressure, pre-selected drilling depth accurate to .004" and the right drill speed for type of work. This compact, easy to mount tool is ideal for high production drilling of small parts. No. 80 to 5/32" drill capacity. For further information on this and other Dumore precision tools, write to The Dumore Company, 1310 Seventeenth Street, Racine, Wisconsin.



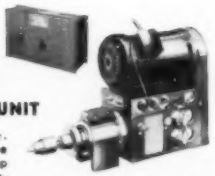
Standard DUMORE Components Make Special Production Machines . . .

for Quick, Low-Cost AUTOMATION

Presto Line Corp., Los Angeles, uses three types of Dumore standard components. These inexpensive precision tools are easily arranged in the set-up as shown. On it, zinc die castings are recessed, tapped and drilled in one continuous operation handled by one man. From 260 to 300 pieces per hour flow through this set-up with *no scrap losses.*

Two Dumore Series 24 Units are mounted on the work table with simple standard nose brackets, one on the right corner and the other opposite. These recess both ends of castings simultaneously. On the other two corners are two Dumore Series 28 Units which tap both ends simultaneously, after castings index automatically from recessing position. The operator then places the workpieces on the fixture above, consisting of six Dumore Series 20 Units which drill six 3/32" holes at once.

By using Dumore standard components, this manufacturer gained quick, precision automation at low initial machine cost.



NEW Series 28 AUTOMATIC "DRILL-N-TAP" UNIT

Two tools in one. Drills or taps at the flip of a switch. Tap fits into chuck, no extra head required. For long or short runs. Reversing motor removes tap, eliminates expensive clutches. Spindle speeds 265 to 4900 rpm. Mounts anywhere with simple nose bracket attachment.

Series 24 AUTOMATIC DRILL UNIT

All controls built-in. For production runs with varying conditions and frequent changeovers — single or multi-unit operations. Variable speeds, feeds, depths. Nose mounting bracket, Hydraulic Feed Control and chip breaking accessories available.

Series 20 AUTOMATIC DRILL HEAD

Economical, dependable unit for small parts drilling. Built-in controls. No. 80 to 5/32" drill capacity.

Get the facts on how Dumore automatic standard components can give you low cost precision automation for your work. Ask your distributor for details, or write . . .

YOU CAN DO MORE WITH DUMORE DRILL UNITS

DRILLING • TAPPING • BORING • MILLING • FACING • REAMING • COUNTERSINK • REAMING

DUMORE

PRECISION TOOLS

1310 Seventeenth Street, Racine, Wisconsin

AUTOMATIC DRILL UNITS
TOOL POST and
HAND GRINDERS

Men at Work

Brown & Sharpe Mfg. Co. recently announced that **Wallace B. Bainton** was made vice-president and general manager for machine tools and **Wallace E. Anderson** became vice-president and general manager for industrial products. Mr. Bainton formerly held the title of vice-president-production and engineering, while Mr. Anderson was general sales manager.

Election of **Stanley J. Roush** to the recently created post of group vice president of Borg-Warner Corp., has been announced. He also retains his positions as president of Atkins Saw Div. of Borg-Warner and president of Morse Chain Co., a subsidiary.

Previously Borg-Warner announced appointment of **G. W. Kelch** as president of the corporation's recently acquired Ingersoll-Humphryes Div. Mr. Kelch formerly was sales manager of the Fisher Scientific Co.

Several appointments announced by Norton Co. involved **Theodore J. Englund** who was made manager of industrial engineering; **Paul L. Lantz**, who became assistant manager of industrial engineering; **William F. Watts**, named factory manager of the Refractories Div.; and **William P. Densmore**, chief industrial engineer in the Refractories Div.

Dora E. Kurtz now heads R and L Tools, succeeding John E. Poorman, founder of the firm, who died recently. Miss Kurtz has been active in the organization since 1929. At the same time it was announced that **Norman Barndt**, assistant to Mr. Poorman for the past eight years, had been named operations supervisor.

Announcement from Sundstrand Machine Tool Co. has revealed appointment of **H. R. Leber** as vice-president of Sundstrand Michigan Corp., a wholly owned Sundstrand subsidiary. Mr. Leber will also continue as general sales manager of the Machine Tool Div. of Sundstrand.

Alfred Iddles, president of Babcock & Wilcox Co., has been elected president of the Atomic Industrial Forum, Inc. for the coming year.

Officers elected to serve American Machine Tool Distributor's Assn. with new president Joseph Owens Jr. include: **Frank H. Habicht** of Marshall & Huschart Machinery Co., first vice-president; **J. O. Ellison** of Harron Rickard & McCone Co. of Northern California, second vice-president; and **J. Russell Clark** of White Star Machinery & Supply Co., secretary-treasurer. Mr. Ellison also is a member of ASTE's Golden Gate chapter.

Newly elected president of Pressed Metal Institute is **Bruce Krasberg**, president of R. Krasberg & Sons Mfg. Co. Other officers elected by the organization included **Clint Stryker**, president of Maysteel Products Inc., first vice-president, and **Carter C. Higgins**, president of Worcester Pressed Steel Co., second vice-president.

Walter R. Bush has been named vice-president in charge of engineering and a member of the management committee of Fenwall Inc. Before joining Fenwal, he was chief components development engineer for Republic Aviation Corp.

Stewart H. Kilmer was made works manager of the Ambridge, Pa., plant of Spang-Chalfant Div. of National Supply Co. He has been general superintendent since 1949. At the same time, **Myron J. Demeter** was promoted to assistant works manager, **George H. Shiveley** to general superintendent and **Herbert T. Bucholtz** to plant controller.

Illinois Tool Works announced that **Donald P. Ridgeway** has been named to the newly established post of manager of the Spiroid Dept. He formerly was vice-president, sales and engineering, for Janette Electric Mfg. Co.

James C. Hodge, vice-president of Warner & Swasey Co., was elected executive vice-president and director. Before joining the firm this year, he was president of Wellman Engineering Co.

Joseph F. Owens, Jr., general manager of J. F. Owens Machinery Co., is new president of American Machine Tool Distributor's Assn. Mr. Owens also is a member of ASTE's Syracuse chapter.

Albert S. Burgoyne was named to the newly created post of vice-president in charge of manufacturing of E. W. Bliss Co. He previously was with the Gage Div. of Pratt and Whitney Co., Inc.

Richard W. Banfield was elected president and chief executive officer of The Motch & Merriweather Machinery Co. He formerly was executive vice-president and director, Niles-Bement-Pond.

Buck AJUST-TRU CHUCKS

"Hold O.D. and I.D. within .001" day in and day out."

Buck Ajust-Tru chucks are ideal for precision grinding. Most recent report is from Mr. Chester Nelson, Supt. Press & Machine Div., J. I. Case Company, Bettendorf, Iowa. He writes—"The part has been O.D. ground on a Centerless Grinder first, then the I.D. is ground by being held in the six (6) jaw Buck Chuck. The accuracy of the Buck Chuck is used to its fullest extent since the O.D. and I.D. have to be concentric within .001" total indicator runout. This tolerance is being held constantly day in and day out."

You, too, can handle precision grinding **faster** and **at less cost** with Buck Ajust-Tru chucks. Takes but a moment to send for literature—write today.

Do you use Power Chucks?

Ask for information about the new Buck standard and Compensating chucks — up to 12".

BUCK TOOL COMPANY

1233 Schippers Lane • Kalamazoo, Michigan

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-188-1

for automatic feeding of Small Parts

SYNTRON

PARTS FEEDERS

of proven dependable Quality

more production, lower job costs

Syntron Vibratory Parts Feeders provide an automatic feed method that will select and feed parts of practically any size, shape or material—single file in oriented position through a gravity fed track to usage points at controllable rates to meet capacities of operations. Electromagnetic vibrations can increase your production automatically.

Write for Catalogue data - FREE

SYNTRON COMPANY

340 Lexington Ave. Homer City, Pa.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-188-2

According to recent announcement, **Robert O. Bass** has been elected executive vice-president and assistant general manager of Morse Chain Co. He also will continue in his previous post as president of Eberhardt-Denver Co. which was purchased this year by Morse Chain.

Elmer D. Robinson, formerly assistant to the president of Morse Chain Co. has been appointed director of manufacturing to head all Morse manufacturing, quality control and industrial relations.

Robert A. Beck recently was named vice-president of City Tool Corp. He also is plant superintendent of the firm.

At the annual meeting of Metal Treating Institute, **H. N. Bosworth,** of Bosworth Steel Treating Co. was reelected president; **K. U. Jenks** of Lindberg Steel Treating Co., Inc. was reelected vice-president; and **L. G. Field** of Greenman Steel Treating Co. was reelected treasurer. Mr. Field also is a member of ASTE's Worcester chapter.

Chedo P. Graham has been promoted to chief engineer of The Aro Equipment Corp. He has been assistant chief Engineer since 1954.

James W. Vicary, president of Ervite Corp., is new president of Porcelain Enamel Institute.

A number of appointments have been announced by Allis-Chalmers Mfg. Co. **J. F. Costigan,** formerly assistant works manager of the Norwood Works, was made assistant director of manufacturing for the company's Industries Group. **L. W. Long** and **J. H. Barrus, Jr.** were named assistant general managers of the Power Equipment Div. **A. I. Thorsen** was appointed general manager of the company's Terre Haute (Ind.) Works succeeding Mr. Long. Mr. Barrus has been manager of Allis-Chalmers Midwest sales region and Mr. Thorsen has been assistant director of manufacturing of the Industries Group.

At Vickers Inc. **Gerhard Reethof** has been named chief of research and **LeRoy D. Taylor** assistant chief engineer for development. Prior to joining Vickers this year, Dr. Reethof was an assistant professor of mechanical engineering at M.I.T. Mr. Taylor, who has been with the firm since 1948, has been responsible for direction of projects involving hydraulic valves and actuators for aircraft surface controls.

During its annual meeting, **Justus T. Vollbrecht,** was elected national president of the Instrument Society of America. Mr. Vollbrecht is founder and president of Energy Control Corp.

TRADE literature

For Free Booklets and Catalogs — Convenient Request Card on Page 169

Furnaces

Well illustrated brochures SC-173, SC-174 and SC-175 present information on company's lines of snap hearth, Allcase and industrial standard rated furnaces respectively pointing out important features and advantages. Surface Combustion Corp., Toledo 1, Ohio. **L-12-1**

Descaling

Illustrated brochure, "Steel Mill Cleaning News," covers descaling of hot rolled steel sheet and strip, slabs and billets and plate; includes case histories taken both from mills and from users' plants. Wheelabrator Corp., Mishawaka, Ind. **L-12-2**

Control Devices

Twelve-page illustrated brochure GEA-6317, "Control Devices for JIC Standards," describes application features and gives product data on company's devices built to meet JIC standards. General Electric Co., Schenectady, 5, N. Y. **L-12-3**

Air Valves

Design and application of air valves treated in 30-page, pocket-size booklet, "The MAC Valve Story"; written in non-technical language. Mechanical Air Controls, Inc., 10030 Capital, Oak Park, Detroit 37, Mich. **L-12-4**

Barrel-Finishing

Revised 76-page Form 501, "Barrel-Finishing with Norton Tumblex Abrasives," includes information on types of barrels, selection of abrasive, cleaners, time cycles etc.; includes before-and-after photos and case histories of deburring, finishing for plating and forming radii. Norton Co., Worcester 6, Mass. **L-12-5**

Boring Tools

Extensively illustrated, 12-page catalog describes complete line of high-speed steel and carbide boring tools for toolroom or production use; also presents data on Moore boring chuck sets, emphasizing design features and advantages; includes data and illustrations covering construction, adjustment and relative sizes of DeVlieg Microbore bars made under license by Moore. Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn. **L-12-6**

Optical Tooling

Twenty-page illustrated booklet explains theory, principles and practice of optical tooling as well as showing applications; also presents complete line of optical tooling instruments and accessories. Charles Bruning Co., Inc., 4700 Montrose Ave., Chicago 41, Ill. **L-12-7**

Coatings

Comparative coatings chart shows resistances obtained by coatings made on vinyl-alkyd, vinyl, chlorinated rubber, silicone, epoxy, epoxy-phenolic and fluorocarbon; also shows comparison of physical properties, application data, cost. J. Landau Co., Carlstadt, N. J. **L-12-8**

Prevent Toolroom Bottlenecks and Increase Production

with *Hammond* of KALAMAZOO

CARBIDE TOOL and CHIP BREAKER GRINDERS

SCE-6 Oscillating Electrolytic Carbide Tool Grinder. The wheel oscillates.

CBW-6 Chip Breaker and Diamond Finishing Grinder. Electrolytic Chip Breaker Grinder also available.

14-WD Wet or Dry 14" Carbide Tool Grinder. 6" and 10" models also available.

SAVE TIME · TOOLS · WHEELS

America's most modern and complete line of Carbide Tool, Chip Breaker and Diamond Finishing Grinders. Over 7,000 *in service.*

Ask for Carbide Grinder Catalog.

Hammond Machinery Builders INC.

1661 DOUGLAS AVE. · KALAMAZOO, MICH.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-189

Socket Screws

Sixteen-page brochure describes and illustrates the Nylok principle incorporated in this line of self-locking socket screws; various examples show variety of applications in which the screws may be used to advantage; includes tables of sizes, dimensions, threads per inch and pertinent technical data. Standard Pressed Steel Co., Box 786, Jenkintown, Pa. **L-12-9**

Comparator

Extensively illustrated 8-page brochure describes Sigmatic mechanical comparator, explaining construction features and advantages. Pratt & Whitney Co., Inc., Charter Oak Blvd., West Hartford 1, Conn. **L-12-10**

Furnace and Oven Controls

Illustrated 45-page Brochure B 43-1 is a condensed bulletin and price list covering Brown Instrument furnace and oven controls. Industrial Div., Minneapolis-Honeywell Regulator Co., Wayne and Windrim Ave., Philadelphia 44, Pa. **L-12-11**

Universal Joints

Cutaway drawings and engineering dimensions and specifications for each of the Almetal universal joints in company's line are features of 8-page catalog; also describes performance characteristics of the joints and explains suitable applications. Detroit Bevel Gear Co., 8130 Jos. Campau, Detroit 11, Mich. **L-12-12**

RUGGED

HEAVY-DUTY HAND CLAMPS

Knu-Vise offers rugged heavy-duty clamps, with solid bar or channel bar, and either hand or air operated, for all kinds of tough holding jobs.

In addition to their stand-up stamina for rough going, these Knu-Vise Clamps feature:

1—Easy and complete replaceability of parts
2—Hardened and ground bearing bolts
3—Minute adjustment of parts through self-locking nuts
4—Toggle Bars from C.R.S. Bars

Developments like these are typical of Lapeer engineering. More information? Write for catalog today on the models available.

Manufacturers of over 150 models of manually and air-operated clamps and pliers

KNU-VISE PRODUCTS LAPEER MANUFACTURING CO.

3053 DAVISON ROAD • LAPEER, MICHIGAN

WESTERN DIVISION: 422 Magnolia, Glendale, California • CANADIAN DIVISION: Higginson Engr., Hamilton, Ontario

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-190

Welding Rods

Informative chart; Bulletin DH-1218-J, compares competitive makes of welding rod; covers physical properties, tensile strength, elongation, average Rockwell hardness, and gives analysis; includes typical uses of gas welding rods, bare electrodes, automatic welding wire and metal spray wire. Page Steel and Wire Div., American Chain & Cable Co., Inc., Monessen, Pa. **L-12-13**

Drilling Unit

Twenty-page brochure, "New Dollars for You," describes economy and other advantages of turret drilling machine; illustrated. Howe & Fant Turret Drilling Machine, 50 W. State St., Westport, Conn. **L-12-14**

Sheaves

Well illustrated by photos and dimensional drawings, Catalog MVD-56 presents detailed information on line of sheaves for multiple V-drives; includes information on installation and specification lists. Maurey Mfg. Corp., 2907-23 S. Wabash Ave., Chicago 16, Ill. **L-12-15**

Industrial X-Ray

Extensively illustrated 12-page booklet, "Norelco X-ray for Industry," contains operating and application data on six different types of radiography units; shows characteristics of all instruments and explains how they are used. Instruments Div., North American Philips Co., Inc., 750 S. Fulton Ave., Mount Vernon, N. Y. **L-12-16**

Heat Treating

"Basic Principles of Quality Gas Carburizing" by company's chief metallurgist, O. E. Cullen, highlights Vol. 7, No. 2 of *Heat Treat Review;* issue also includes articles on annealing and age hardening of copper alloy coils and TV controlled slab furnaces. Surface Combustion Corp., Toledo 1, Ohio. **L-12-17**

Carbides

Carbide Grades Chart shows carbide grade recommendations showing grades and numbers of 12 manufacturers. Request only on company letterhead directly to Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.

Motors

Two 11-page bulletins, GEC-1026A and GEC-1027A, give buying information on selected group of motors; include application data, ratings and prices for fractional horsepower motors, integral-horsepower polyphase and single phase induction motors, etc. General Electric Co., Schenectady 5, N. Y. **L-12-18**

Milling Cutters

Illustrated 29-page Catalog 561 describes line of milling cutters; with separate sections dealing with high-speed steel and carbide; each section also broken down into light, medium and heavy duty cutters; covers dimensions and prices. The Viking Tool Co., 1000 Nichols Rd., P.O. Box 471, Shelton, Conn. **L-12-19**

Air-Cylinders

Series A nonrotating air cylinders described in 12-page illustrated Catalog No. 110; contains complete engineering data on 21 models ranging from 1½ through 14 in. bore sizes. The S-P Mfg. Corp., 30201 Aurora Rd., Solon, Ohio. **L-12-20**

Lubrication

Distribution systems for all types of Bijur automatic lubricators described and illustrated in 12-page Bulletin 4A; discusses detailed planning of systems and their applications to machinery; other sections deal with analysis of oil distribution and how systems are engineered; includes schematic layouts of systems and actual installations. Service, Bijur Lubricating Corp., 151 W. Passaic St., Rochelle Park, N. J. **L-12-21**

Controls

"Save Time and Money by Breadboarding," reprinted from Control Engineering, gives general information on this broad field and describes this method for solving, in the lab, problems involving control of processes and equipment. Servomechanisms, Inc., Mechatrol Div., 625 Main St., Westbury, L. I., N. Y. **L-12-22**

Speed Reducers

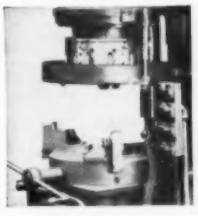
Illustrated, 44-page "Speed Reducer Engineering Manual," Booklet B-6727, presents complete application information plus discussion of construction features, installation and maintenance suggestions. Westinghouse Electric Corp., P.O. Box 2099, Pittsburgh 30, Pa. **L-12-23**

Burrs and Files

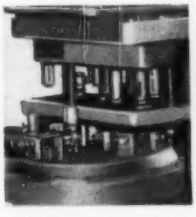
Twelve-page brochure illustrates and describes line of carbide burrs and rotary files; includes graphs with pictures to show various models giving head diameters and cutting lengths. Second folder similarly presents and describes carbide tipped end mills and carbide tipped reamers. Both booklets also contain complete list with photos and dimensions of standard carbide and high-speed steel tools. The Essex Rotary File & Tool Corp., 295 Madison Ave., New York 17, N. Y. **L-12-24**

AUTOMATION THAT'S EASILY RETOOLED FOR CHANGES

Baker Basic machines don't have to be "rebuilt" when you change your product or methods . . . cost much less than a machine specially designed for only one part . . . and pay for themselves even on lower production runs. Yet they still give you full automation with loading and unloading devices and conveyors . . . which we'll furnish as well as tooling. Use singly or in battery as a transfer machine . . . for drilling, boring, tapping, facing and other machining operations. 5 sizes.



Boring



Drilling and reaming with index fixture

Multiple drilling

BAKER
AUTOMATION
Best in the long run
Practical in the short run

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Please send free Catalog on Baker Basics and automation with standard machines.

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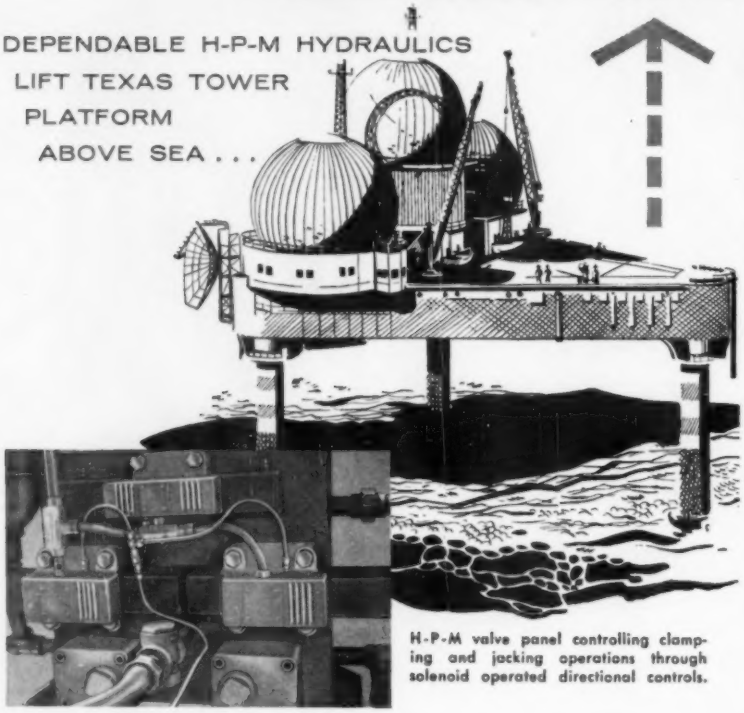
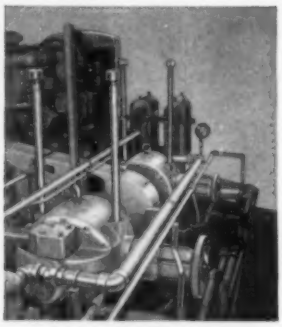
COMING UP!

DEPENDABLE H-P-M HYDRAULICS
LIFT TEXAS TOWER
PLATFORM
ABOVE SEA . . .



H-P-M valve panel controlling clamping and jacking operations through solenoid operated directional controls.



H-P-M double pump, double circuit, power unit with single diesel engine drive.

After the temporary legs of the Texas Tower have been lowered to the Atlantic's floor, the job of raising this immense "island" platform weighing approximately 10,000,000 pounds, above the ocean level, begins . . . and dependable H-P-M hydraulics were chosen for this important task. Up it goes—approximately 55 feet above the sea . . . slowly, carefully, on the three supporting columns. Each column is independently controlled, hydraulically, so that leveling is simplified regardless of the condition.

Not everyone faces this kind of engineering problem. Not everyone needs an immense power source such as this. But if DEPENDABILITY is your problem—rely on H-P-M hydraulics for the answer. Pumps, valves, cylinders for every heavy requirement.

HYDRAULIC POWER DIVISION
THE HYDRAULIC PRESS MFG. CO.
Mount Gilead, Ohio, U.S.A.
A DIVISION OF KOEHRING COMPANY

HPM

NFPA NATIONAL FLUID POWER ASSOCIATION

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-192

Welding

New 52-page manual serves as pocket encyclopedia of practical welding information; covers all methods of metal joinery usual to welding shops plus data on cutting without oxygen; includes work on aluminum and aluminum alloys, cast iron, copper and copper bearing alloys, magnesium, monel, nickel, stainless steel, steel and zinc-base die cast. Free to any company or instructor. Request directly to All-State Welding Alloys Co., Inc., 249-55 Ferris Ave., White Plains, N. Y.

Conveyors

Catalog No. 500 covers company's featured products and equipment in line of material handling conveyors, pointing out important advantages, features and uses; illustrated by photos, drawings and diagrams. Prab Conveyors, Inc., 30121 Groesbeck Hwy., Roseville, Mich. **L-12-25**

Gage Components

"Gage Components for Process and Design Engineering" offers informative data on complete line illustrated by photos and dimensional drawings; loose leafed for user convenience, the catalog is sectionalized according to types of gages; set of tracing templates also included. Request only on company letterhead direct to A. G. Davis Gage & Engineering Co., 21435 Dequindre Rd., Hazel Park, Mich.

Powder Metal Presses

Complete line of powder metal presses including 37 models ranging in capacity from 1½ to 300 ton, both single punch and rotary types, described in 24-page Catalog No. 815. Well illustrated. F. J. Stokes Corp., 5500 Tabor Rd., Philadelphia 20, Pa. **L-12-26**

Self-Locking Nuts

Complete information on sizes and prices of line of self-locking metal nuts contained in 6-page loose-leaf catalog pointing out construction, features, applications and advantages; illustrated by photos and drawings. Con-Torq, Inc., North & Judd Mfg. Co., New Britain, Conn. **L-12-27**

Decorating Equipment

Illustrated brochure provides guide for selecting best spray gun action, type of mask or other decorating equipment for each particular type of part. Pictures demonstrate, step by step, use of painting fixtures and of screens and fixtures for silk screen process; also serves as guide for roller coating and paint-and-wipe technique. Finish Engineering Co., Inc., 1115 Cherry St., Erie, Pa. **L-12-28**

technical Shorts

TWO MANUFACTURERS of jet airplane engines are ready to launch tests on recently developed high temperature alloys according to report made by The Tungsten Institute.

Test Alloys For Jet Applications

The alloys, which promise to offer particular suitability for jet aircraft and other super temperature uses, are being developed as part of a tungsten research program sponsored by the Institute through a contract with Stanford Research Institute. The researchers hope to develop an alloy to meet the need of modern aircraft for a high strength steel that will maintain its hardness and strength when considerably higher tempering temperatures are employed. Study is being directed by R. H. Thielmann, chairman of the subcommittee on power plant materials, National Advisory Committee for Aeronautics.

* * *

A NEW HIGH-INTENSITY fluoroscope, developed by the Navy Ordnance Laboratory to permit faster detection of flaws in aircraft metal castings, is currently under test by Chance Vought Aircraft to determine its accuracy, rate of inspection and its general aircraft usefulness. Approximately 2000 large and small castings of steel and magnesium were scheduled for inspection during the test period. Parts viewed in the fluoroscope are ones already inspected by the conventional X-ray filming method, although the operator is not informed of the condition of the castings beforehand, and maintains detailed records of his results. These results are compared with the initial X-ray films to check the accuracy of the new fluoroscopic system.

Industrial Fluoroscope Speeds Checking

Smaller castings to be inspected in the new machine are held in position inside plastic globes by a cushion of small rubber balloons. The sealed globe is positioned between the fluoroscope's X-ray tube and the 8-in. viewing screen and the technician inspects for flaws on the viewing screen. Through the use of the controls in a shielded booth, the plastic ball and its casting cargo is rotated so than it can be inspected from all angles.

Operating reports are kept of how fast castings can be inspected, operator darkroom adaptability, operator fatigue and the accuracy of fluoroscopic findings checked against the X-ray photos. The operator looks for cracks, porosity, voids and other defects which may not meet company standards. Monthly reports on the program are sent to the Bureau of Aeronautics.

* * *

FINELY DIVIDED NYLON powders have been combined in a formula termed Nylasint 64 by National Polymer Products, Inc. and provide exceptionally strong parts in the cold pressed and sintered form. A prime use of Nylasint powders has been in the forming of mechanical components by

Use Nylon Powder For Quality Parts

For metal-cutting specialties
consult these
CIRCLE R
specialists
BUREANK
Production Machinery Sales Inc.
CHICAGO
Donald Robertson & Co.
CLEVELAND
Production Tool Co.
DAYTON
J. R. Kuntz Company
DETROIT
A. D. Spruce
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The Eaton Company
INDIANAPOLIS
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PHILADELPHIA
General Tool Sales Co.
PHOENIX
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CIRCLE R Representatives specialize in metal-cutting problems. Their individual competence is backed by our factory consultation service. Rely on them for specialties to solve the new problems of automation, as well for standard saws and other circular cutting tools. Ask for Catalog N.
We develop special tools to solve problems of automation
METAL SLITTING SAWS
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CUT OFF SAWS • CIRCULAR KNIVES & ROTARY SHEAR BLADES • CIRCOLOY STEEL SAWS • SOLID & TIPPED TUNGSTEN CARBIDE SAWS
COMBINED DRILLS & COUNTERSINKS • CENTER REAMERS
CIRCULAR TOOL CO., INC.
PROVIDENCE 5, RHODE ISLAND
Specialists in Circular Cutting Tools Since 1923
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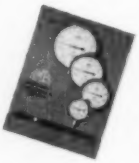
Check Motions or Dimensions
In .001" up to 10" Range.

Ames Long Range Dial Indicators in a variety of models are made for quality control applications requiring close tolerance and inspection. For example, you can measure in .001", long slide travel, large cams, deep recesses or other dimensions requiring indicator spindle travel of up to 10".

In addition, Ames Long Range models have all the advantages that are built into Ames regular indicators:— dials of large diameter; easy-to-read, widely spaced graduations; movable dials; replaceable contacts. All Ames Long Range indicators have count hands to indicate revolutions of the indicator hand. Those with box covered, rack guide have a slot in the cover graduated to register each inch of spindle movement.

Write today, sending your problem in long range measuring. Ames will be glad to suggest a solution. Be sure to include drawings and specifications – your answer will be back faster if you do.



Representatives in principal cities

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cold pressing and oil sintering under the melting point, somewhat similar to techniques used in powder metallurgy. Various inert fillers, such as molybdenum disulphide, graphite, etc. provide specific property advantages.

The parts formed have wear resistance, low surface friction, and low hygroscopic and thermal expansion. They have a high modulus of elasticity and low deformation under load. They also have low starting friction following the oil sintering process.

Halex Corp., licensed fabricators of the parts, reports that gears formed from the new impact resistance Nylasint 64-MS, which is 10 percent molybdenum disulphide, press to satisfactory tolerances and have prospects for use in a variety of gear applications.

The parts are economically mass produced, have uniform shrinkage and accurate profiles. Parts produced from the material do not require degating and contain no flash lines, while possibilities of stress spots or internal strain are measurably reduced as compared to parts made from earlier formulations. The use of Nylasint 64-MS gears should minimize the possibility of failure in operation due to peening.

In addition to gears, the new formulation is expected to be applicable for forming bearings, rollers, bushings, cams and similar wear parts.

* * *

Researchers Develop Tandem Transistor

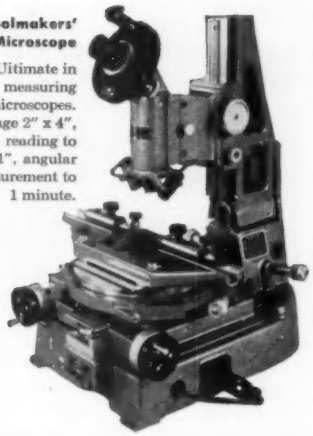
ELECTRONIC EXPERTS are hailing development of a tandem transistor by the Marvelco Electronic Div. of National Aircraft Corp. for use in the semiconductor field. The new component developed by Dr. H. E. Hollmann, Marvelco director of research is a d-c-coupled, two-stage cascade housed in a single case, and is not a twin or dual transistor with two independent semiconductor elements.

Available in limited quantities for laboratory use at present, production in commercial quantities is expected to begin shortly. Predicted applications are as a high-gain amplifier, oscillator, multivibrator, flip-flop, switching device, etc.

In the tandem transistor, a common-collector transistor stage is the input device of a second transistor to serve as a useful type of d-c transformer. Current gain reaches values as high as 75 db, while high input resistance and low output resistance permit tandem transistors to be driven by high-impedance sources and to be cascaded by means of RC-coupling without necessity of matching transformers. No extra power is required because the input transistor forms the base leak for its successor.

Toolmakers' Microscope

Ultimate in measuring microscopes. Range 2" x 4", reading to 0.0001", angular measurement to 1 minute.



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Precise, versatile, easy-to-use Gaertner measuring microscopes assure positive, direct measurement of precision parts. You see clear, sharply-defined images. No physical contact to distort or injure object being measured. Enjoy new production savings with Gaertner optical instrumentation. Write for complete data on the Gaertner line of industrial microscopes.

Coordinate Measuring Microscope

High precision, low cost instrument for 2-dimensional linear measurement. Range 2" x 2", reading to 0.0001".

Micrometer Slide Comparator

Reliable, low cost instrument for linear measurement. Ranges up to 4", reading to 0.0001" or 0.00005".

Scale Micrometer or Shop Microscope

High quality, low cost instrument with range up to 0.100". Reading to 0.001", easy interpolation to 0.0002"..

Write for Bulletin 161-54 showing applications, models, specifications.

The Gaertner Scientific Corporation

1241 Wrightwood Ave., Chicago 14, Ill.
Telephone: BUckingham 1-5335

INDICATE A-12-195-1

who's meeting and where

Jan. 14-16. 3RD NATIONAL SYMPOSIUM ON RELIABILITY AND QUALITY CONTROL IN ELECTRONICS, Hotel Statler, Washington, D. C., sponsored by The Institute of Radio Engineers, The American Society for Quality Control, The Radio-Electronic-Television Manufacturers Assn. Engineering Dept., and The American Institute of Electrical Engineers. For more information contact R. G. Murrell, Melpar, Inc., Falls Church, Va.

Jan. 14-18. SOCIETY OF AUTOMOTIVE ENGINEERS, INC. Annual meeting, Sheraton-Cadillac and Statler Hotels, Detroit, Mich. Other details may be obtained from society office, 29 W. 39th St., New York 18, N. Y.

Jan. 16-17. SOCIETY OF PLASTICS ENGINEERS. National technical conference, Sheraton-Jefferson Hotel, St. Louis, Mo. For details, write to the society office, 513 Securities Bank Bldg., Athens, Ohio.

Jan. 28-31. PLANT MAINTENANCE & ENGINEERING SHOW, Public Auditorium, Cleveland, Ohio. For more information, contact the exposition management, Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

Jan. 30-31. AMERICAN SOCIETY FOR ENGINEERING EDUCATION. Annual college-industry conference sponsored by ASEE Relations-with-Industry Div., under auspices of UCLA College of Engineering and University Extension, at University of California, Los Angeles. Direct inquiries to University of California Extension, Engineering, Los Angeles 24, Calif.

Jan. 30-31. ILLINOIS INSTITUTE OF TECHNOLOGY. Midwest welding conference sponsored jointly by Armour Research and Chicago chapter of American Welding Society, Illinois Tech Chemistry Bldg., 3255 S. Dearborn St., Chicago, Ill. Write for details to Harry Schwartzbert, Supervisor of Welding Research, Armour Research Foundation, 10 W. 35th St., Chicago 16, Ill.

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INDICATE A-12-195-2

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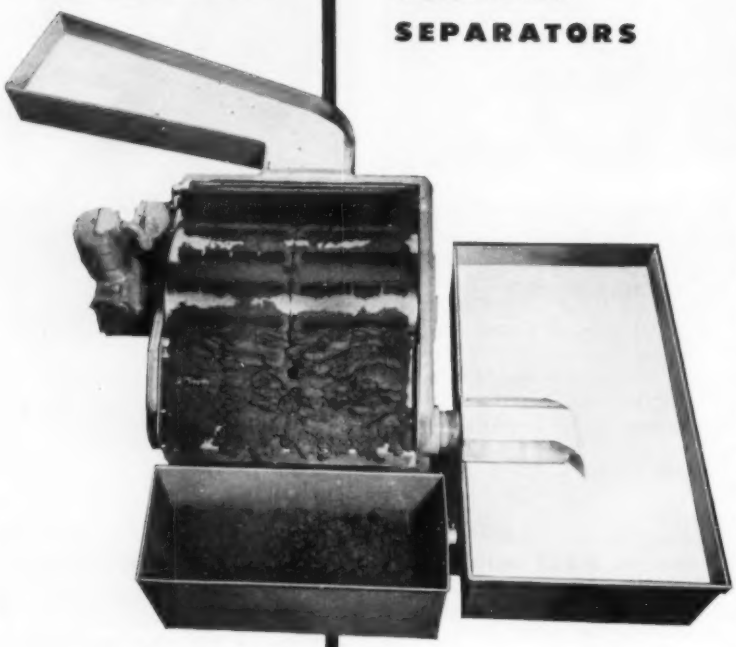

give you these features for

Practical
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CLEANING

✻ **AUTOMATIC** — The Separator requires no attention other than periodic emptying of the sludge pan.

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DOUBLE CLEANING ACTION — magnetized particles form a fan-shaped pattern on the surface of the magnetic drum which serves to "comb out" free abrasive or other materials as the drum rotates.

RAPID SEPARATION — coolant is processed rapidly, flowing by gravity through the separator, for effective circulation at all times. No additional coolant supply necessary to compensate for the cleaning operation.

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Barnesdril Automatic Coolant Separators remove swarf, sludge and abrasive particles automatically from soluble and oil coolants. Built in ten sizes — 1½, 3, 5, 10, 20, 30, 70, 100, 280 and 350 gallons per minute capacity.

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EXTRUSION OF PLASTICS, RUBBER AND METALS—*by Herbert R. Simonds, Archie J. Weith and William Schack. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Price $10. 463 pages.*

Extrusion is an efficient and versatile method of fashioning materials. Although in use since the beginning of the nineteenth century, the process is finding increased application in industry today.

The first section of the book discusses extruding plastics. Methods of dry extrusion, such as multiple screw machines, multi colored products, sheets and films, and methods of compressing, pelletizing and extrusion packaging are described in detail.

The remainder of the book deals with extrusions of metals, rubber, food products, ceramics, graphite and even ice.

THE CONDENSED CHEMICAL DICTIONARY —*5th Ed.—by Arthur and Elizabeth Rose. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Price $12.50. 1220 pages.*

This new fifth edition contains over 30,000 entries. Included are data on chemical and physical properties of chemicals and raw materials; information on containers, shipping regulations and safety instructions; new uses of chemicals in nuclear energy, chemotherapy and other fields of current interest. Cross reference help clarify the confusion often associated with chemicals and their applications.

HANDBOOK OF FASTENING AND JOINING OF METAL PARTS—*by Vallory H. Laughner and Augustus D. Hargan. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price $15. 622 pages.*

Planned to help both designers and production men, the book covers accepted practice in assembling or fastening metal parts. It discusses methods of joining dissimilar metals, types of resins and adhesives that can be used and the advantages of different types of joints.

The first section of the book covers fundamentals of various fasteners and fastening techniques. Because techniques differ, chapters are basically unrelated. The second section or supplement is a pictorial outlay of easy-to-follow picture and caption style that gives practical answers to fastening problems.

RECRUITING AND SELECTING OFFICE EMPLOYEES—*by Milton M. Mandell. Published by American Management Association, 1515 Broadway, New York 36, N. Y. Price $4.75. 175 pages.*

For the most part, the office has tended to lag behind other corporate divisions—production, engineering, etc., in the streamlining of operations and the effect control of rising costs. Even in the small shops or businesses most people are content with cutting costs by revamping production setups or buying new machines. However, little thought is given to the office.

The American Management Association surveyed 320 companies to get useful information about job evaluation, recruitment, problems in selection of personnel and the selection of supervisors and managers. The data of this survey were organized and analyzed and the results appear in this report.

Part one discusses recruitment programs of office workers through the selection of their supervisors. New techniques and systems are discussed which produce more information for decision-making.

Part two contains an entire section devoted to model forms. These include job descriptions, application blanks, interview rating forms, tests, reference inquiries, performance follow-up forms and merit rating forms.

RESISTANCE WELDING THEORY AND USE—*Prepared by Resistance Welding Committee, American Welding Society. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Price $4.50. 173 pages.*

Applications of resistance welding have rapidly expanded in the past fifteen years. While much technical data has been published to assist in making most effective use of resistance welding, little consideration has been given to the fundamentals.

This book covers all the resistance welding processes and describes the different types of resistance welding machines, electrodes and controls. One chapter deals with welding symbols used in making drawings to be used in manufacture and fabrication. These symbols convey to the engineer the thought or idea of the designer more accurately than many words. Weldability of different metals is discussed, and how quality control and inspection is applied to obtain consistently good welds.

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Standardization on Chicago-Latrobe High Speed and Carbide Drills is becoming commonplace with production experts. Reason? Better production results . . . less down time . . . fewer re-grinds. Another reason? Chicago-Latrobe distributors carry the most complete stock and consequently offer unexcelled service. Order Chicago-Latrobe next time—specify "no substitute."

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• REAMERS • COUNTERBORES • SPECIAL TOOLS

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Chipping and Edge Breakdown Eliminated by Switching to **STELLITE** *Alloy Tools*

HAYNES STELLITE Star J-Metal tools mill an average of 220 of these cast iron differential housings per grind despite periodic contact with hard white iron spots. Chipping and edge breakdown, major problems when other tool materials were used, have been eliminated by switching to STELLITE alloy tools. As a result, unscheduled down time has been drastically cut. About 3/16 in. of stock is removed from each casting with 0.010 to 0.012 in. chip load per tooth. Cutting speed is 88 surface ft. per minute. The 40 standard Ingersoll-type blades mounted in a 12-in. cutter can be counted on for a full shift's production.

HAYNES STELLITE alloy tools are successful on applications like this one because they have good impact strength, high compressive strength, and their cutting edges remain hard and sharp even when red hot. They resist chipping and spalling in spite of severe shock. Metal removal is fast because high speeds, comparatively high feed rates, and deep cuts can be used.

For more information on efficient metal removal with HAYNES STELLITE tools, write for the booklet, "HAYNES STELLITE Metal-Cutting Tools." It gives information on chip formation, tool design, and grinding procedures.

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FIELD notes

Following five years of cooperative research and development work with the Research Laboratories Div. of General Motors Corp., Haynes Stellite Co., Div. of Union Carbide and Carbon Corp., has been licensed to produce and sell GMR-235, a nickel-base, high temperature alloy containing chromium, molybdenum, iron and boron with aluminum and titanium as precipitation-hardening agents. The alloy is produced both by air-melting and vacuum-melting techniques.

V V V

Shaw Development Corp., a subsidiary of British Industries Corp., has completed pilot foundry and laboratory to license American Foundries and train personnel of Shaw process licensees in application of that method for making investment castings. The new facility is located in Port Washington, N. Y.

V V V

Gregory Industries, Inc. has established a $1500 cash award to be presented annually for the most outstanding contribution to further development of electric arc stud welding. The cash award—or $2000 in scholarships for any individual or school of the winner's choice—will be made to "the person responsible for development of stud welding applications or studs which shall be judged most significant on the basis of: Reducing costs for industry; or improving appearance, serviceability and life of a product or structure; or performing a function not possible by any other method.

research

Plans to add a nuclear research reactor to its scientific facilities have been made public by Westinghouse Research Laboratories. This will be the first such reactor to be built by an industrial firm solely for its own research use. Dr. J. A. Hutcheson, vice-president in charge of engineering, and Dr. Clarence Zener, acting director of the Research Laboratories, outlined long-range plans for the facility. The reactor will be housed in a central, cylindrical section of a new building with offices and laboratories on either side. According to schedule, the reactor will be completed within the next two years.

At the same time, company officials described plans for addition of a 6-million-volt Van de Graaff generator at the Laboratories to assist in study of fundamental structure of matter. The accelerator and research reactor are separate projects and will be housed in different buildings.

V V V

Plans for a research and development center in Stamford as headquarters for its Central Engineering Laboratories has been announced by American Machine & Foundry Co. No manufacturing would be conducted at the center as the Laboratory's activity is entirely concerned with research and development engineering. According to present plans, the facility will cost approximately $4-million.

V V V

One of the largest industrial science centers in the United States has been opened by Cool Electric Co. The center, involving seven buildings, is located on a 15-acre tract in Morton Grove, Ill., near Chicago. It will be operated by more than 1,000 research scientists, engineers, technicians and other staff personnel.

new companies

Formation of Dynex, Inc., has recently been announced as a development of the Hydraulic Control Div. of Blackhawk Mfg. Co. Products of the new company, located at 1500 S. Muskego Ave., Milwaukee, Wis., will consist of a line of hydraulic piston pumps, valves, motors and cylinders.

V V V

Ten large corporations have formed a new company called Industrial Reactor Laboratories, Inc. which was created to build and operate a privately owned nuclear reactor for industrial research in atomic energy at Plainsboro, N. J. Participating companies are Atlas Powder Co., AMF Atomics Inc. (subsidiary of American Machine & Foundry Co.), American Tobacco Co., Continental Can Co., Corning Glass Works, National Distillers Products Corp., National Lead Co., Radio Corp. of America, Socony Mobil Oil Co., and United States Rubber Co.

V V V

Armco International Corp. of Middletown, Ohio, and August Thyssen-Huette A.G. of Duisburg-Hamborn, Germany, have completed agreement to form a joint steel fabricating company with its operational headquarters in Dinslaker in the Ruhr Valley. Initial investment will amount to more than $500,000. The company will fabricate specialty steel products using processes developed by Armco.

V V V

Vac-U-Lift Co. is the new name of the Blakeslee Mfg. Co. of Salem, Ill. At the same time, the company revealed that it had become a division of Hufford Machine Works, Inc.

new facilities

$1½-million is scheduled for investment by General Electric's Medium Induction Motor Dept. in a developmental laboratory in Schenectady, N. Y. The laboratory, which will be concerned with creation of new products and improvement in present lines, is to be completed by 1958.

V V V

The Carpenter Steel Co. has opened a new and larger mill-branch warehouse in Buffalo, N. Y. to facilitate distribution of specialty steels in that area.

V V V

Capacity for automatic heat treatment of precision threaded fasteners at Standard Pressed Steel Co. has been increased to more than 100,000 screws per hour with the installation of a second automated line. The line, built by Surface Combustion Corp., is constructed around a 30-ft. long radiant-tube hardening furnace. It is 110 ft long and is serviced by a three-story-high system for air and oil cooling.

V V V

Square D Co. is building a major manufacturing plant in Lexington, Ky., and a smaller regional assembly plant in Atlanta, Ga. Both facilities are scheduled for completion in 1957. Walter Nollenberger, chief manufacturing engineer of Square D's Distribution

Equipment Div., has been named manager of the Lexington unit. Stephen Kovach, who has been supervisor of the industrial engineering section in the company's Royal Oak plant, will be manager of the Atlanta facility. Mr. Nollenberger is a member of ASTE's Pontiac chapter.

v v v

Construction of a $2-million central service building is under way for Norton Co.'s Worcester, Mass. plant. The three-and-a-half acre factory and office facility will centralize under one roof the plants engineering department and a variety of crafts which service the entire plant.

acquisitions

More than 90 percent of the outstanding shares of Brown Industries, Inc. has been acquired by Sterling Foundry Co., a subsidiary of The Warner & Swasey Co. Purpose of the acquisition is to provide availability of larger foundry capacity for the parent company's expanding machine tool business. Brown Industries will be operated as an independent unit under Sterling Foundry management.

v v v

Outstanding capital stock of the Grove Valve and Regulator Co. and Grove Controls, Inc. have been acquired by Walworth Co.

v v v

Shareholders of Topp Industries, Inc. have voted to acquire assets of Heli-Coil Corp. in a three-way merger. Assets of the combined companies will amount to about $8-million. This total includes assets of Haller, Raymond and Brown, Inc. recently acquired subsidiary of Topp.

v v v

Bendix-Westinghouse Automotive Air Brake Co. has arranged to purchase Servel, Inc.'s assets and facilities for the manufacture of refrigeration compressors. These facilities will be operated by Bendix-Westinghouse in two former Servel buildings at Evansville, Ind. Purchase included land and buildings, machinery and equipment, inventories, patents, trade marks and technical information.

v v v

New Plastic Corp. recently purchased Lansco Die Casting Co. as a wholly owned subsidiary. According to New Plastic announcement, acquisition of Lansco provides the parent company with control of costs and quality for many of their existing products.

expansions

Manufacturing capacity of New York Twist Drill Co., Inc. has been doubled with completion of a new plant adjacent to the firm's present building at Westbury, L. I.

v v v

Detroit Broach & Machine Co. is building a 15,000-sq ft addition to its plant in Rochester, Mich.

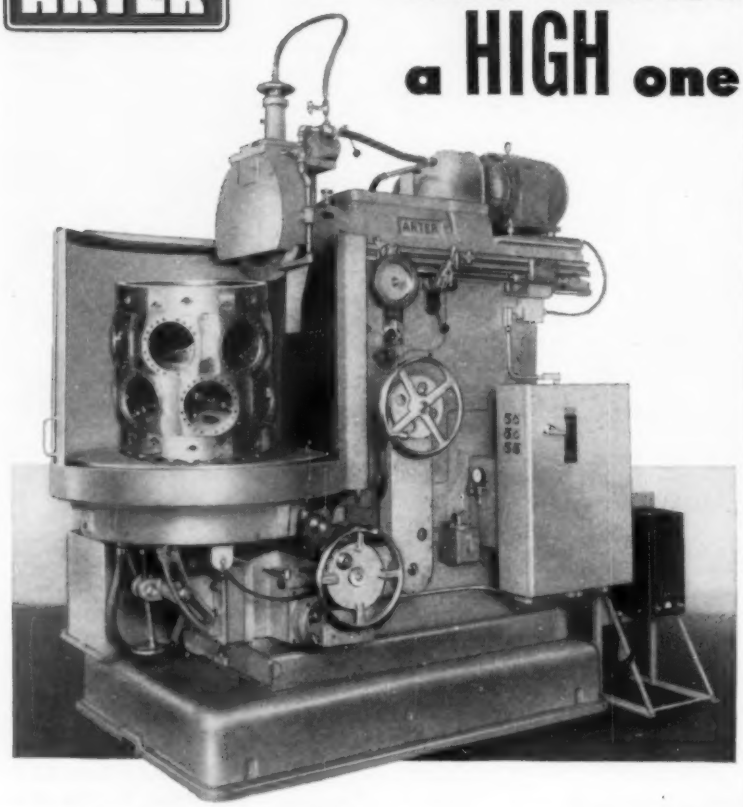
v v v

The addition to American Drill Bushing Co.'s factory at 5107 Pacific Blvd. in Los Angeles is near completion. The new building will house, in addition to offices and other facilities, a factory area which will double output of drill jig bushing production.

v v v

An estimated $3-million will be spent by Charles Bruning Co., Inc. for its new manufacturing plant and office building in Mount Prospect, Ill. The

ARTER also makes a HIGH one



Vertical capacity of Arter Model B Hydraulic Rotary Surface Grinder can be increased 24" using a raising block. So, for grinding surfaces on such work as the crankshaft housing for the piston-type airplane engine, as shown, Arter has the answer. Arter has been building rotary surface grinders for nearly forty years. Model B is built in four sizes — 20", 24", 30" and 40" diameters.

Whatever your surface grinding needs, Arter can meet them.

ARTER GRINDING MACHINE COMPANY

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Jigmatic Automatic Tape Controlled Positioning Table • Rotary Surface Grinders
Flat Circular Cutter Grinders • Internal Grinders • Cylindrical Grinders • Carbide Tool Grinders

AGENTS IN INDUSTRIAL CENTERS OF UNITED STATES AND CANADA

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structure, which will more than double the size of the company's two separate Chicago plants which it will replace, is scheduled for occupancy by July 1, 1957.

v v v

Dedication ceremonies and open-house marked completion of an addition to the Joseph T. Ryerson & Son, Inc. steel service plant in Jersey City, N. J. The enlarged plant now has approximately 355,000 sq ft of space devoted to warehousing, processing and shipping steel.

v v v

Firth-Loach Metals, Inc. is completing an expansion program which will provide an increase in production capacity by more than 40 percent. An extension for more than 2,000 sq ft was added to the McKeesport plant in addition to new equipment.

v v v

Extensive facilities for production of aluminum plate will be added to the sheet and foil rolling mill now under construction at Ravenswood for Kaiser Aluminum & Chemical Corp. New facilities will include a 144-in. plate mill, heat treating facilities and ultrasonic testing equipment, as well as a large plate stretcher capable of stress-relieving aluminum alloy plate up to 6 in. thick.

new companies

Tool Supply & Engineering Co. has announced creation of its Machine Tool Sales Co. Div. This division has just been moved into a new facility at 1811 Canton St. in Dallas.

v v v

Three new divisions have been created by Norton Co. They are the Abrasive Div. headed by John Jeppson as vice-president and general manager, the Refractories Div. with William G. Fallon as general manager, and the Electro-Chemical Div. with Howard J. Daly as vice-president and general manager.

v v v

Wallco Mfg. Div. was formed recently by Wall Colmonoy Corp. Wallco, formerly known as the Furnace Brazing Div., now offers increased facilities for design, development and manufacture of brazed assemblies.

v v v

The Yale & Towne Mfg. Co. is planning a modern industrial lift truck sales and service branch in Los Angeles as its first step in a western expansion program. The new branch is operating

modern MACHINES *demand*

MODERN *solid carbide* TOOLING!

Jarvis SOLID CARBIDE GIVES MAXIMUM EFFICIENCY AND ECONOMY!

Forward-thinking management demands a tool in step with the times—a tool that delivers accuracy with SPEED!—and pays for itself by producing *more* for *longer* periods. That's why the big swing is to Jarvis carbide tools!

Jarvis tools are solid carbide—skillfully engineered to perform to ten-thousandths tolerances—and afford all the benefits of increased production and guaranteed economy inherent in carbide. Specify Jarvis... it's the *profitable thing to do!*

Jarvis designs and manufactures Special Tools for specific applications. Send details for prompt quotation. *A Jarvis Representative is as near as your phone!*

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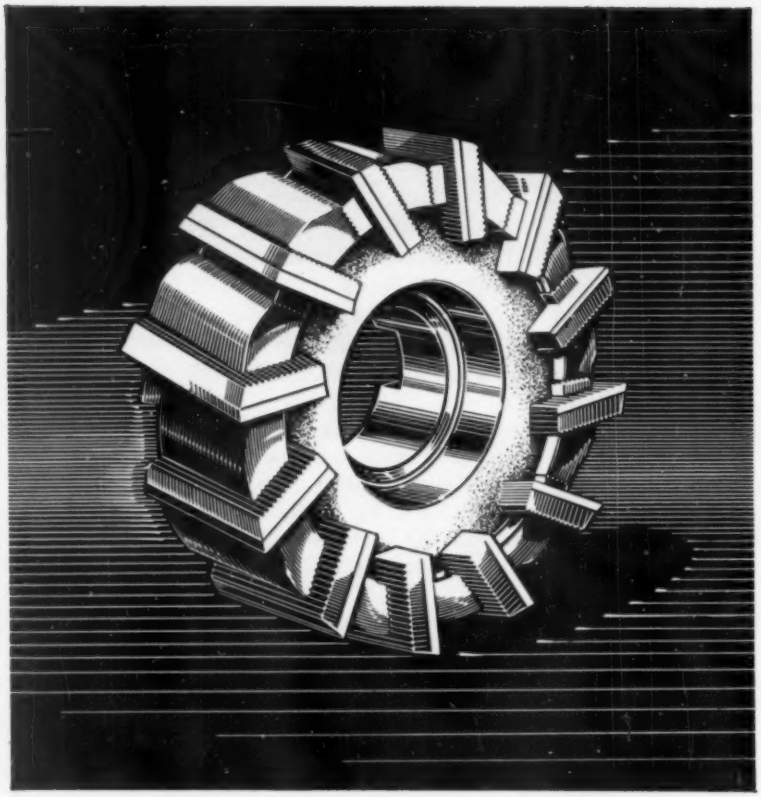

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Sure, that's the best description you could apply to a Go & Go inserted high-speed steel blade milling cutter. Here's a tool that's equally at home banging out high production day after day or down in the toolroom carefully carving out a new die. And you can use it on almost any material.

When blades wear, and they do, it's a simple matter to set them out, resharpen and put the cutter back in production. After you've squeezed the last bit of tool life out of the blades, just order new ones from stock and insert them in the cutter body. Blade cost is so low most shops keep several sets on hand all the time.

You can choose just about any style and size of inserted HSS blade milling cutter you'll ever need from the complete line of standards manufactured and stocked by Go & Go. For specifications, ask for Catalog "F". Go & Go also designs and manufactures special milling cutters in quantity. Check your nearest Go & Go representative for details.

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DETROIT 23, MICHIGAN
Engineering and producing tools that Go & Go since 1917.

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in temporary quarters pending completion of the new building at Olympic Blvd. and Gerhart St., East Los Angeles.

v v v

A division for the fabrication and sale of steel springs has been formed by Crucible Steel Co. of America. The new organization combines previously existing Crucible spring fabrication and sales activities. Thomas J. Crowley has been named general manager of the division which will have headquarters at Spring Works, McCandless Ave. in Pittsburgh.

name changes

Ferguson Machine & Tool Co. of St. Louis has announced additional acquisition of facilities in Lebanon, Ind., and also a change in firm name to Ferguson Machine Corp. of Indiana. The new plant, which will be known as the Hicks Development Div., will be devoted to design and building of automatic tooling for use with the company's basic transfer units.

v v v

Name of Ettco Tool Co. has been changed to Ettco Tool & Machine Co., Inc. to provide a designation which is considered more descriptive of the full scope of line presently manufactured by the firm.

v v v

As of January 1st Modern Corp. will be known as Modco Tools, Div. of Valeron Corp. The name change is being made in order to identify the firm more closely with its products and services.

moves

Toolset, Inc. has moved to new and larger quarters at 1411 Military Rd. in Buffalo, N. Y. The transfer of general offices, engineering, assembly and warehousing has released space for expansion of present machine shop facilities.

v v v

The Asco Pacific Coast Factory Branch of Automatic Switch Co. has been moved to expanded facilities at 1233 Goodrich Blvd., Los Angeles.

v v v

Cleveland offices of Link-Belt Co. have been moved to larger quarters in a new building at 3592 Lee Rd.

v v v

Latest in a series of expansion moves has been completed by Verson Allsteel Press Co. with opening of new offices at 93rd St. and Kenwood in Chicago.

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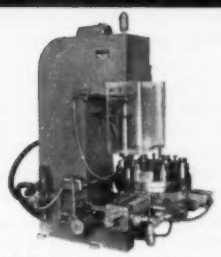

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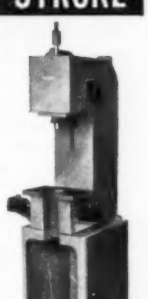

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abstracts of FOREIGN LITERATURE

By M. Kronenberg
Consulting Engineer

Unbalance in Grinding Wheels

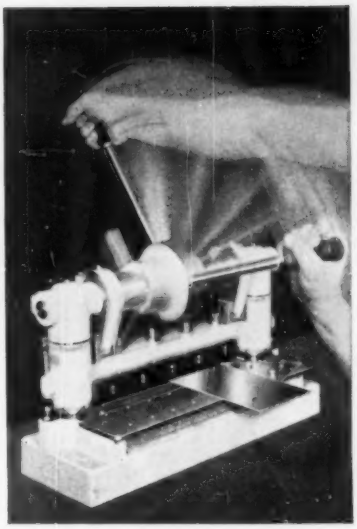
Unbalance in grinding wheels is due to two major causes; namely, variations in the density of the wheels and deviations from a true cylindrical shape. High stresses are set up in the wheels leading eventually to the wheel bursting and endangering the machine operator and others.

Although tests have previously been run to determine these stresses, the results did not agree with actual practice until H. Munnich conceived the idea of investigating the stresses by means of strain gages. This way he proposed to correlate stresses, unbalance, safety, bursting speed, clamping forces and other such factors which govern the manufacture and application of grinding wheels. The author reports on his investigation in a book based on his doctor's thesis and published by *H. E. Ummen Verlag.*

Specimens were cut from the finished grinding wheels with diamond saws to specified dimensions. A technique was developed for securely attaching strain gages to the surfaces of the specimen, which could then be placed in a testing machine for determining tensile strength. In this way it was possible to obtain information on the modulus of elasticity and of lateral contraction of grinding wheel materials.

Tests were also run on a high-speed testing machine rotating at 40,000 rpm. This was equipped with a device for collecting and retaining the parts of grinding wheels deliberately stressed until they burst.

Additional tests with strain gages were also run on rotating grinding wheels where the strain gages were attached to the circumference, the bore and faces of the wheel. Further tests were measured and computed forces exerted by the clamping disks for various diameters, various types and brands of wheels, and various bonds. The speed at which wheels burst, once they had a crack, was found to be be-



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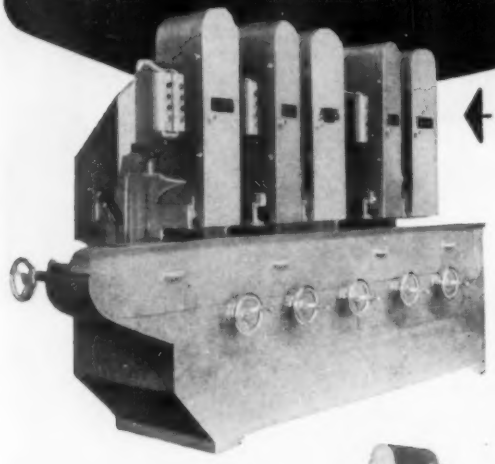

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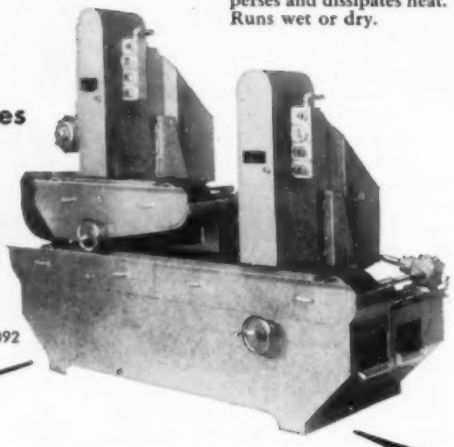
Model 2-1092



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tween 60 and 90 fps. Such cracks can be detected by tapping the wheel slightly before mounting it. The author recommends running a grinding wheel for about 5 minutes before using it in the grinding process.

Tool Life and Vibration

Tool life, as is well known, is greatly affected by vibration even though it may be scarcely perceptible. An interesting investigation of the relationship between the two factors has been published by R. Weilenmann in Issue No. 9, 1956 of *Werkstattstechnik und Maschinenbau*. This contains a method of computing the drop in tool life in relationship to vibration. Certain assumptions had to be made in order to develop a mathematical formula, among them the assumption that the vibration corresponds to a cosine function and that the only one frequency of vibration is present. Actually, the vibration is considerably more complex, but the agreement between theory and practice is relatively good although improvements of the theory may be anticipated.

The author indicates that the phase difference between cutting speed change and change in chip cross-sectional area is an important factor in the effect of vibration on tool life. If the cutting speed reaches maximum at the same instant that the chip cross-sectional area becomes maximum, the tool life becomes minimum. Tool life improves rapidly as the phase difference between these two quantities increases. It would follow from theory that an improvement in tool life could be obtained under vibratory circumstances, if the cutting speed were maximum at the instant that the chip cross-sectional area would be at a minimum, corresponding to a phase difference of negative 180 deg.

The author makes use of Kronenberg's cutting speed equations where the exponents of depth of cut and feed are smaller than 1.0 and shows that variations in cutting speed affect tool life more than changes in the chip cross-sectional area. This was confirmed in practice where an increase of 25 percent in cutting speed caused a greater reduction in tool life than an increase in the chip cross-sectional area by 25 percent. Similar conclusions apply to torsional vibration of milling cutters, where the time of penetration of the cutting edge into the workpiece has an effect on the tool life of the cutter.

Hannover Industrial Show

A report on the Industrial Show held at Hannover in 1956 was published by K. Schroedter and G. Sternfeld in Issue No. 7, 1956 of *Werkstatt und Betrieb*. The article deals with measuring and testing devices, electrical equipment,

transmissions, tools, chucks, welding and cutting appliances, and plant transportation.

Among the measuring instruments was a device for measuring the wall thickness of transparent hollow bodies made of glass, plastics and similar materials. Another instrument made it possible to measure the burr produced by punching tools to an accuracy of ±0.0004 inch. The instrument is placed on the workpiece and moved toward the burr until the burr can clearly be seen through a magnifying system with reference scales.

Nonmetallic Surface Plates

The usefulness, selection and preparation of stones for surface plates is discussed in an article by H. Schmidt in the same issue. The methods used for testing the surface plates are discussed and it is indicated that five classes have been standardized for the accuracy of such plates depending on their length.

Nonmetallic surface plates are also made with steel rail inserts at the periphery, permitting attachment of dial indicators. Since magnetic stands cannot be used for dial indicators on nonmetallic surface plates, pneumatic stands have been developed which hold the indicators securely in place.

Warm Shearing of Steel

Werner Lueg and Guenter Mueller have carried out research into problems of cutting steel on shears at elevated temperatures. They indicate that little data are available and that warm shearing is still a process depending largely on experience.

They have used a hydraulic press equipped with shears, which could be run at speeds up to about 70 fpm at a pressure of 250 tons. Cutting forces were determined by means of strain gages inserted between tool and upper bracket of the press. As they report in *Stahl und Eisen*, No. 14, 1956, cutting speeds were varied between 0.2 ips and 250 ips. The knives were adjusted to a gap of 0.020 inch, while the temperatures were changed in five steps from about 1300 to 2000 F.

The authors came to the conclusion that some of the steels investigated performed like brittle materials and others like plastic materials. In those with plastic behavior the cut did not penetrate deeper than the knives at any instant, while in brittle behavior the material was rapidly sheared ahead of the knives. Data presented in tables and curves refer to the forces depending on penetration, cutting speeds and temperatures. Cutting forces increase up to about 20 percent of the travel and drop thereafter.

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how to reduce lead time through planning and scheduling

Aircraft Production Forum

Tech Digests

Panel

J. W. Armantrout, Lockheed Aircraft Corp., Burbank, Calif.
W. E. Masehal, Douglas Aircraft Co., Inc., Santa Monica, Calif.
T. L. McCarthy, Northrop Aircraft, Inc., Hawthorne, Calif.
J. C. Mueller, North American Aviation, Inc., Los Angeles, Calif.

SINCE COMPETITION is so keen in the aircraft industry, every manufacturer of complete units or components must face the fact that minimum lead time is essential to existence. Speed today ranks along with proficiency of design and quality of product in importance. No unit of an organization can escape sharing the burden and must assist in devising ways and means of meeting this challenge.

Insofar as engineering is concerned, there are two fundamental considerations in planning for reduced lead time. First, the whole engineering program must be arranged so that drawings are completed and released as nearly as possible in sequence and on due dates, as needed by tooling, manufacturing and purchasing.

The second major consideration is that the engineering program must be planned so that the engineering design and all related activities proceed in an orderly manner with sufficient time so that the design is right when the drawings are released. This assumes, of course, that there are an adequate organization and sufficient numbers of competent engineers available at the time needed.

Making a Master Schedule

To determine sequence and dates for releases of engineering drawings an assembly flow chart or its equivalent is needed, *Fig.* 1. This shows scheduled start and finish dates of major components of the airplane. It is prepared and refined during many conferences between engineering, tooling and manufacturing. Quite simply, for each major component, it is necessary to start from the point of assembly and determine the amount of time needed for tooling and manufacturing, thus establishing the desired engineering release date for the drawings needed.

Considerations in the preparation of such a master schedule are the nature of the product itself, number of units to be produced, and the rate of production required. After this information has been developed, the manufacturer must recognize certain abilities and limitations of his facility which spell the success or failure in producing the article. These include money, or extent of risk, plant and equipment capacities, material availability, manpower and required skills.

In considering available facilities, plant capacity must be examined as to needs for expansion or modernization. Thought must be given to the extent to which subcontracted or outside production facilities might be used.

Because of strong trends in design improvements, every manufacturer must be alert to needs for new or special equipment required to produce the article. Also highly important is the recognition of needs for suppliers to invent, research, develop, test and finally provide any new materials involved.

Once determined, the master schedule must be what the name implies. From its first inception to delivery of the last unit, the most stringent adherence is mandatory. Equally important is the need for the manufacturer to set up adequate controls to insure this.

Planning and tooling in many companies have long been recognized as the "how" departments. They can be compared to a shock absorber which is compressed from top and fixed at the bottom. In many companies, responsibility for the production breakdown and manufacturing sequence is placed in the hands of tool engineering.

Another time saver is utilization of special projects departments made up of top-flight mechanics who can make many early parts on a limited quantity basis without special tooling.

Procurement and Subcontracting

In the procurement of materials and subcontracting several short cuts are possible. Close liaison must be maintained with subcontractors to help them work out their problems. Significant milestones should be established in each program so the subcontractors' prog-

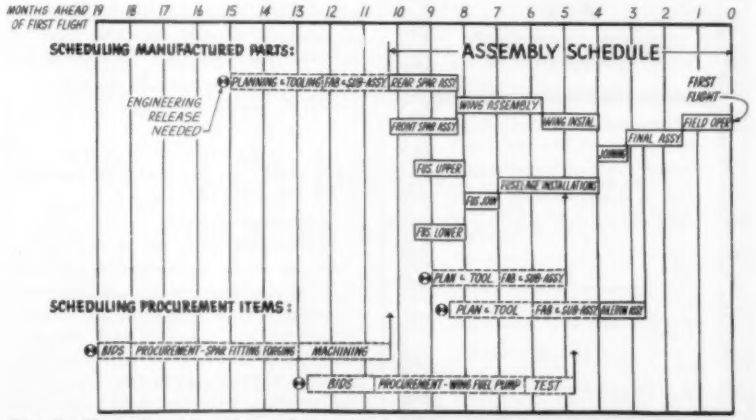

Fig. 1. Typical engineering release schedule for a new aircraft design.

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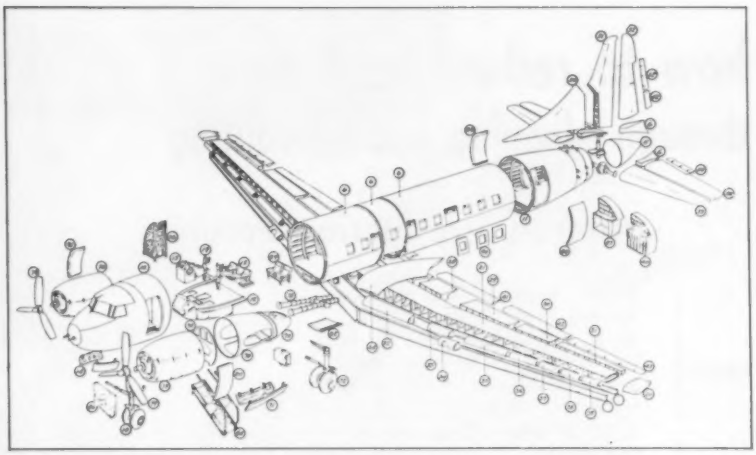

Fig. 2. Exploded production breakdown of the aircraft is the first step in determining manufacturing and tooling sequences.

ress, particularly in planning and tooling, can be readily determined. Most of all, it is necessary to select capable subcontractors, set fair prices and negotiate program adjustments promptly. It is also a considerable help to early establish accurately subcontract requirements. In this way, the effort and facility capability to accomplish them can be known and a realistic evaluation of subcontract bids is possible.

In materials procurement, similar principles can be used. For instance, the contract and management policies should be defined in terms that the buying agency understands. The product design should be defined so that maximum advantage can be taken of small business capability in buying "system packages." Schedule adjustments should be made through daily contact with design groups. Control must be maintained of the program in building and testing phases to adjust inventory and procure change requirements, avoiding work stoppage.

In addition, there are a number of tricks of the trade, some of which can be used to shorten the flow time of parts for the first ship. These include:

1. Making material substitutions
2. Making parts by hand or with temporary tools
3. Constructing basic tools first
4. Working parts ahead of schedule
5. Using priority systems
6. Spliting orders
7. Installing parts out of sequence.

At this early stage, preliminary design may indicate use of new materials requiring new techniques of fabrication. Manufacturing research and development should be aware of such problems. Many potential production problems can be solved and thus reduce the lead time required.

Coordinating Tooling

After the master schedule has been established, a basic tooling policy should be issued. This indicates in a general way how the product is to be planned and tooled, based on analysis of the product, *Fig.* 2. Its purpose is to have everyone thinking along similar lines; for instance, the extent of temporary or soft type tooling for the first phase of production.

While "make or buy" decisions are not entirely the responsibility of the tooling function, these decisions are to a large extent based on information furnished by tool engineering. It is essential that interchangeability and replaceability requirements be established early so that fabrication of master tooling can be started.

Throughout the entire engineering phase, from the time the first line is drawn, planning and tooling should be in action. Thus when final engineering drawings are available, planners and tool designers have only to compare and correct differences from advance engineering. Such methods will reduce the time lag between planning and tooling.

Progressive planning can be used to eliminate delays in obtaining the first subassembly. Minimum tooling can be used for first lot production. Complete production tooling can follow with a practical schedule. On tight programs this relieves the tool fabrication area for essential items. An example is replacement of forgings, often unavailable for the first few subassemblies, with billets, which are hogged out.

Another important fact is that production flow time tends to decrease as the production rate increases, *Fig.* 3. This is due to the fact that flow time on a continuous production line is

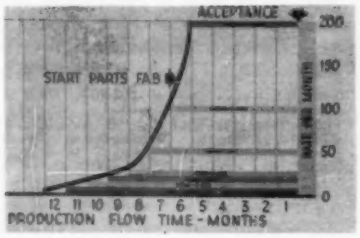

Fig. 3. Chart indicating comparison of production flow time from initial production later products at a peak rate of production.

equal to the number of stations divided by the production rate. There are also a number of tricks that can be used to shorten the flow time after the peak rate of production has been achieved. These include:

1. Reducing storage pads
2. Eliminating dead stations
3. Combining assembly cycles
4. Extending continuous production
5. Balancing assembly lines.

To summarize, a firm minimum requirement schedule must be established if production of the first article is to be accomplished in the shortest possible time. A tough control must be set as a challenge to the entire organization.

Concise measures of actual progress against this schedule must be made periodically and made known to all departments responsible for the plan. These measures should be as simple as possible so that all personnel can readily know the extent to which the program is ahead of or behind schedule.

All levels of line supervision must act promptly upon unfavorable trends revealed by measures of actual progress against the schedule. Action should be directed to bolster functions which are behind schedule and to estimate functions next in sequence to attempt to make up lost time.

It is thus apparent that reduction in lead time depends on cooperation between the various departments of a company and coordination of their activities toward the common goal. The best planning is of little value unless engineering, tooling and manufacturing have the help of an understanding management. Such a management will seek continually to develop a team spirit between departments and divisions and this can go a long way in helping to reduce time for aircraft and other products as well.

From the SAE West Coast Aircraft Production Forum, Los Angeles, 1956. Copies of the complete forum may be obtained from SAE Headquarters, 485 Lexington Avenue, New York 17.

▼ ▼ ▼

Great Britain's Experience with Air Pollution

By S. G. G. Wilkinson

Ministry of Housing and Local Government
London, England

Britain's annual bill, in terms of money alone reaches a staggering total of 250 million pounds as the cost of air pollution. This stands in comparison with figures estimated for Pittsburgh of over $55 for each inhabitant. Cost is $14 per head for the population of Britain as a whole. According to the Beaver Committee's report at the end of 1954, 4,000 deaths in December 1952, from the smog which covered London for four and a half days, indicates that pollution is a dangerous enemy to human health.

The government has lost no time in implementing the Committee's recommendations. A Clean Air Bill is on its

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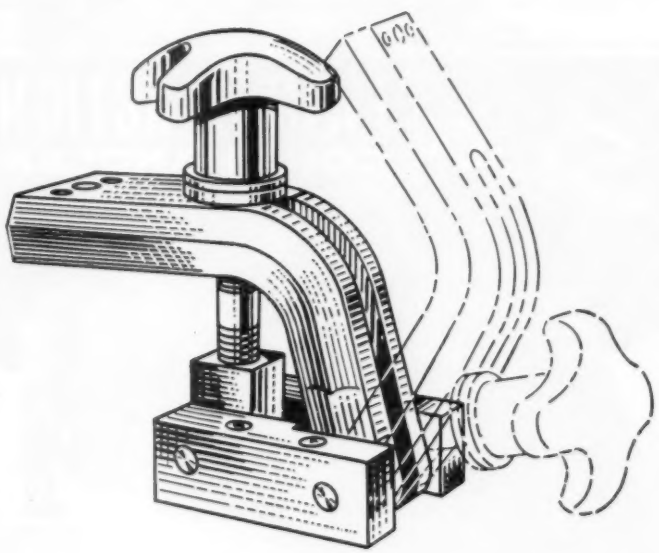

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way through Parliament and may have become a law by now. It repeals nearly all present legislation on smoke pollution and substitutes a single code. The main features of this are:

1. Discharge of dark smoke from any chimney is prohibited, subject to limited exceptions such as the lighting of furnaces when cold. The prohibition applies also to locomotives and ships.
2. Any practicable means available must be utilized to minimize the release of grit or dust from furnaces. New furnaces must be equipped with apparatus to arrest grit or dust.
3. The foregoing provisions, which mainly affect industry, will operate over the whole country. Enforcement is the responsibility of local authorities.
4. Smoke from other sources, including domestic smoke, is dealt with on a local, and in a sense, voluntary basis.

Local authorities will establish smoke control areas, in which smoke emission from buildings is prohibited. Householders will be entitled to grants for replacing apparatus where necessary, to enable smokeless fuel to be burnt.

Present arrangements regarding control of pollution from special processes by the Alkali Inspectorate are not disturbed. Supplementary provisions deal with new furnace design, smoke density meters, height of new chimneys and pollution from colliery spoilbanks.

The report indicates that domestic fires were responsible for nearly half the smoke in the atmosphere. Supplies of domestic smokeless fuels are limited in Britain. The main substitute is coke. Most grates must be replaced to burn this fuel. So the abolition of smoke will be a slow process. A long term program of 10 to 15 years is envisioned to deal with large urban areas alone.

From a paper given at the 70th Annual Meeting of The Engineering Institute of Canada, Home address 2050 Mansfield St., Montreal 2, Quebec.

▼ ▼ ▼

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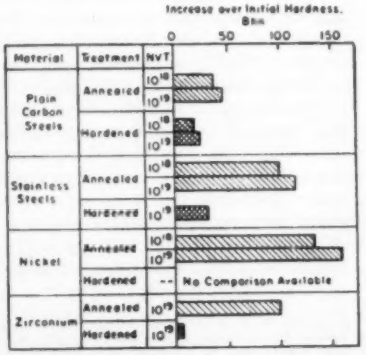
Effects of Irradiation on Solid Materials

By H. H. Hausner
General Manager
Nuclear Engineering Div.
Penn-Texas Corp.
New York, N. Y.

The metallurgical problems which still offer most of the difficulties connected with the design of nuclear power reactors are those in connection with the effects labeled as "radiation damage." Frankly speaking, I do not like the term because it sounds too sensational and because it is also wrong in several instances.

To generalize, we may state that irradiation of solid materials usually causes changes in hardness (usually an increase), in strength (tensile strength and especially yield strength), in ductility (usually a decrease), in electrical resistivity (usually an increase), as well as many other changes. All these effects depend on the type and level of radiation, the environmental conditions under which the exposure takes place and the type and processing treatment of the material.



Effect of irradiation on hardness of various metals.

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The effect of irradiation on the hardness of some metals is shown in the accompanying figure. This graphical representation indicates that steels, nickel and zirconium increase in hardness under irradiation, and that this hardening depends on the radiation level and the type and state of the metal. The increase of hardness of annealed metals is considerably greater than that of hardened metals.

Hardening and annealing are complex processes. The main factor which distinguishes a hardened material from an annealed one is the crystal lattice structure of the metal. Hardened materials are usually characterized by a large amount of disorders in the crystal lattices, whereas the lattices in annealed materials are more "ordered." From the data shown, it can be concluded that metals with ordered lattices change more in hardness under irradiation than do metals with disordered or defective lattices.

From a paper given at the Twelfth Annual Meeting of the Metal Powder Association, 130 W. 42nd St., New York 36, N. Y.

▼ ▼ ▼

Development of Safe Welding Practices

By R. L. Snyders
General Motors Institute
Flint, Mich.
and
L. J. Rose
Fisher Body Div., GMC.
Detroit 2, Mich.

An unusual approach is used in the development of recommended welding safe practices in General Motors Corp. In committee activity, a group of welding engineers, interested in safety, accept the responsibilities of planning, organizing and reviewing proposed safe practices recommended by the members of the task group.

In a joint committee, consisting of the welding safe practices task group and key personnel appointed by the director of safety of G. M. and the director of plant protection, a "clearing house" is established for review and finalization of these procedures. The paper explains in detail, just how this system operates. A breakdown of the areas considered for establishing safe practices in welding is further described.

In general, seven basic principles of safety have become established for safe plant operation. Safety hazards are defined, and statistics discussed which indicate percentage of accidents caused

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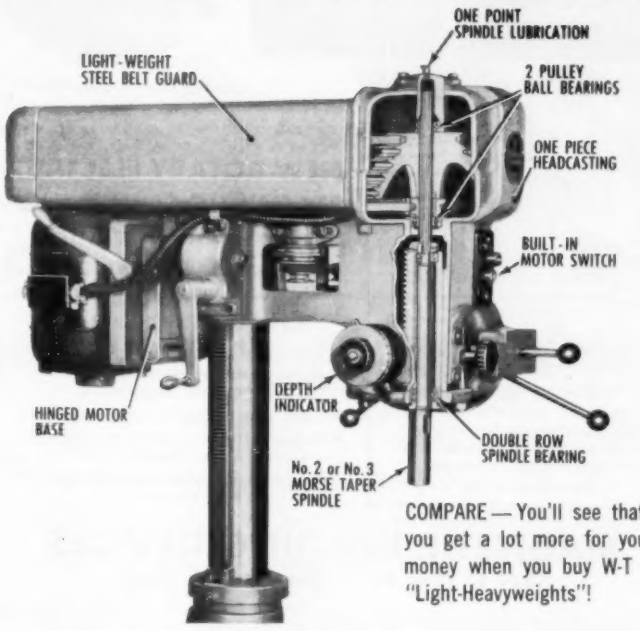

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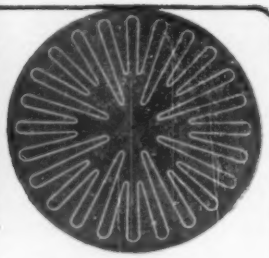

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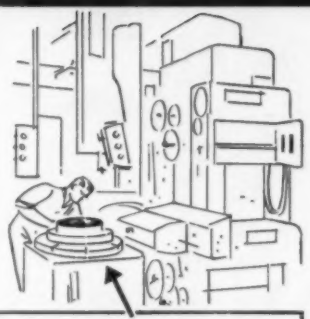

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tech digests

by unsafe acts, mechanical failure and those classified as unpreventable.

The safety program is based on the principles developed by the committee. The data is utilized to augment or modify existing safety material pertaining to welding.

As machine and welding processes improve and changes are made in industry, it is continually necessary to alter and add safety rules for safe plant operation.

From a paper given at the 1956 annual meeting of the American Welding Society, 33 W. 39th St., New York 18, N. Y.

▼ ▼ ▼

Ultrasonic Welding

By J. B. Jones
Aeroprojects, Inc.
West Chester, Pa.

and

J. J. Powers, Jr.
Pitman Dunn-Labs

Solid state bonding has been achieved with both similar and dissimilar metals by the introduction of elastic vibratory energy in the area to be joined. This process may be accomplished without the application of heat except that which is associated with dissipation of the vibratory energy. The process is immediately applicable in joining foil and thin sheet to either very thin or massive members.

The paper discusses the power source and the presently utilized transducer-coupling system. Power, vibratory energy exposure time, and static clamping force are also discussed.

Both strength and deformation of the weld zone are compared to characteristic values incident to ordinary high-pressure welding and resistance spot-welds. The same order of strength has been obtained as with these older techniques but with lower deformation.

The paper also presents representative photomicrographs of characteristic solid state metallurgical bonds achieved with the process between various similar and dissimilar metals.

From a paper given at the 1956 annual meeting of the American Welding Society, 33 W. 39th St., New York 18, N. Y.

▼ ▼ ▼

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Tracer Machining in Job Shops

By James Dillon

President and General Manager
Darco Industries, Inc.
Los Angeles, Calif.

Success in job shop operations is closely related to versatility. The tracer-controlled machine has become a great asset to the job machine shop operator. It has enabled him with minimum outlay to get into a class of work which formerly required capital investments of hundreds of thousands of dollars.

By improved techniques and use of this newly developed tool, the job shop has taken a definitely needed and permanent place in aircraft and missile production programs. This is the stop gap that can hog out plates, billets and slabs to complicated engineering designs for test parts, tooling tryouts, engineering changes, quick fixes and short production runs where forging dies are too costly.

The job shop must be able to take in a large variety of work, quote and meet quick and short due dates, operate with minimum tooling and deliver quality products at low cost.

Tracer machining has been found to be an integral part of this program. This company has utilized machine conversions, such as the open side planer, *Fig.* 1, which is excellent for flycutting. By locking one horizontal tracer valve sector and using a counterweight on the stylus, an automatic power feed is secured and any straight-line feed rate from 0 to 60 ipm. It is possible to stack four times the amount of work on the table area and increase production accordingly.

As many as five different small jobs are set upon one machine at a time, where runs are intermittent, and parts held up for heat treat, engineering clarification, waiting for material, etc. The operator moves from one job to another with little lost time due to setup. Usually this is accomplished merely by changing cutter and stylus.

To standardize tooling and reduce setup time, master holes are tooled in all templates and holding fixtures and use a constant distance from cutter to stylus. For close tolerance jobs, leveling screws are used to match tooling plate to holding fixture. A variety of tooling is used depending on type of work. Flat templates cut out from photo aluminum sheet, wood or metal patterns used with a work-holding fixture, combination or stacking templates with flat overlays or three-dimensional overlays, built up sheet aluminum templates in laminates and sample part are the most common types.

Ninety percent of the work, primarily aircraft parts, *Fig.* 2, finds its way to the tracer machine for at least one operation. The machines have been used as vertical mills, slab mills, profile mills, drill presses, jig borers, routers and various combinations including three-dimensional duplicating.

Advantage of this type of setup includes:

1. Well balanced machine load
2. Less tooling

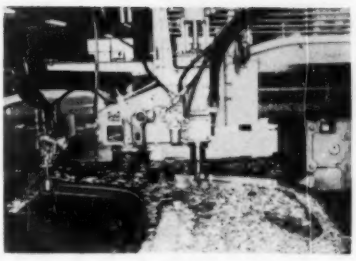

Fig. 1. Open side planer converted to tracer operation takes a typical contour cut in an aircraft part.

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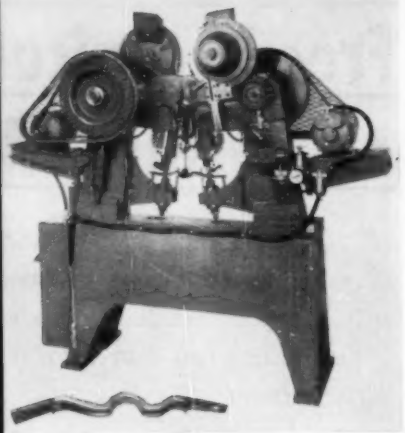

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Fig. 2. Typical contoured parts for aircraft industry.

3. Better quality
4. Increased production
5. Lower costs
6. More stable backlog.

Indirectly there are additional benefits by being able to bid on almost any job offered, being more competitive and running more complicated parts. Often it is possible to reduce machine time on contouring operations as, for example, on one part, from two hours per piece to 7½ minutes. These conversions pay for themselves in less than a year.

The job shop in seeking new and varied types of work should first acquire the tools to perform the jobs. People should be trained to efficiently use the tools and then the tools can be made to perform the jobs by properly planning flow and performance of production efforts. By applying these principles, the job shop can establish an efficiency of manufacturing performance and be able to keep abreast or ahead of changing requirements.

From a paper given at the Contour Machining Conference sponsored by Tru-Trace Corp., Los Angeles, Calif., Oct. 1956.

▼ ▼ ▼

Arc Cutting Aluminum

By L. L. O'Brien

Linde Air Products Co.
New York 17, New York

Tungsten-arc cutting is a new, high speed process which promises to be a valuable production tool for the aluminum industry. In this process, a highly constricted arc combined with a high-velocity shielding gas produces good cut surfaces of saw-like quality. The process can be used mechanically or manually, in any position, for cutting straight lines, bevels, circles, and shapes. Cutting speeds are generally several times faster than speeds attained with other severing methods.

This paper discusses the theory and development of tungsten arc cutting. In addition, the paper describes results obtained with the process in terms of actual production application.

From a paper given at the 1956 annual meeting of the American Welding Society, 33 W. 39th St., New York 18, N. Y.

Developments in Fire Resistant Hydraulic Fluids

Machine Tool Hydraulic Forum

Considering the total volume of fluids used in machine tools, it can be said that the degree of adoption of fire resistant fluids is low. However, there are numerous industrial applications where the use of these fluids is in order. Producers of fire resistant fluids advocate their use only where exposure to a possible source of ignition exists.

In certain operations, such as a hot saw in the steel industry, there is an inherent hazard in the operation. In other applications, a source of ignition might exist in vacinity in which the machine is used. Such might be gas fired furnaces, welding operations, field rheostats, etc. In such cases the use of fire resistant fluid is the only practical solution.

Considering applications where a fire hazard exist, there is an increasing degree of adoption of these fluids.

Fire resistant fluids are significantly different from standard hydraulic oils. These differences must be recognized if they are to be used successfully. Even more important is the fact that there are several types of fire resistant fluids and they differ from each other as much and sometimes more than from conventional oils.

Use of these fluids should be regarded as safety insurance. If there is no hazard, and this applies to a large percentage of machine tool installations, certainly there is no need to use anything except the high quality hydraulic oils available. Once the need for using a fire resistant fluid has been established, the most important single consideration is to put them into clean systems, to avoid contamination and follow best and soundest preventative maintenance practices for hydraulic fluids.

From an open discussion at the Vickers Production Machine Tool Hydraulic Forum, Detroit, Mich., 1956.

▼ ▼ ▼

How To Diversify

By Thomas R. Rudel

President
Rudel Machinery Co.
New York, N. Y.

Many modern plants, particularly those in which obsolete tooling has been regularly replaced and improved, have a host of machine tools whose capacities and potential are not being fully used. Management should consult regularly with representatives of tool makers, plant tool engineers and machine tool supervisors and operators in planning for product diversification. Their knowledge of what machine tools will do can be highly important to diversification programs.

No matter how attractive market possibilities of a new product may look, no well-managed company leaps into a situation in which it cannot manufacture the additional product at a profit with something reasonably close to its present labor force, tools and plant facilities.

Careful examination of existing tooling will, in many cases, show that it is flexible and versatile enough to be adjusted and adapted to many new product uses—with comparatively modest investment for new components, fixtures and accessories.

From a talk given at the Eastern Plant Management Conference of National Metal Trades Association, New York, N. Y.

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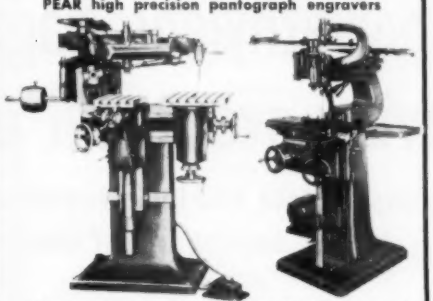

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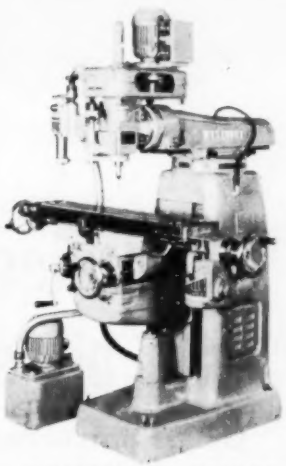

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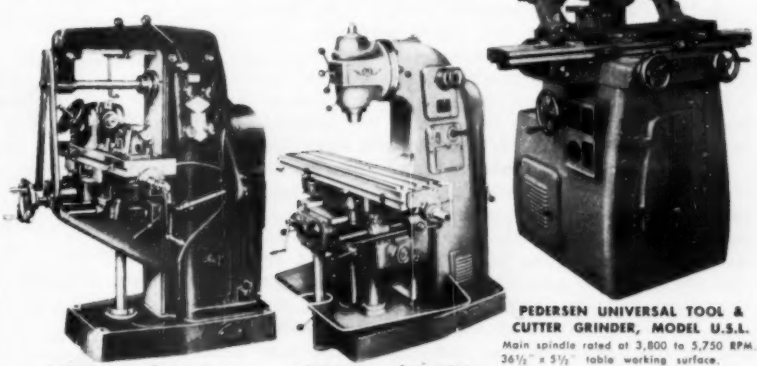

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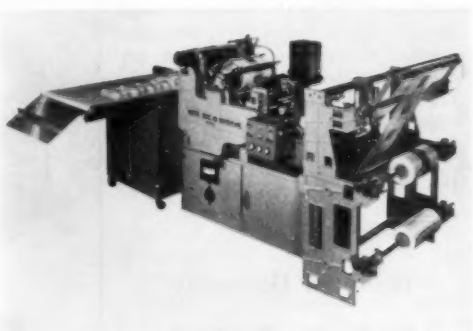

A view of the Roto-Bag machine which is equipped with dies made of hard, long-lasting Kennametal.

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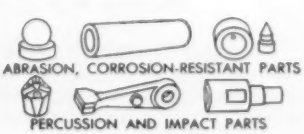

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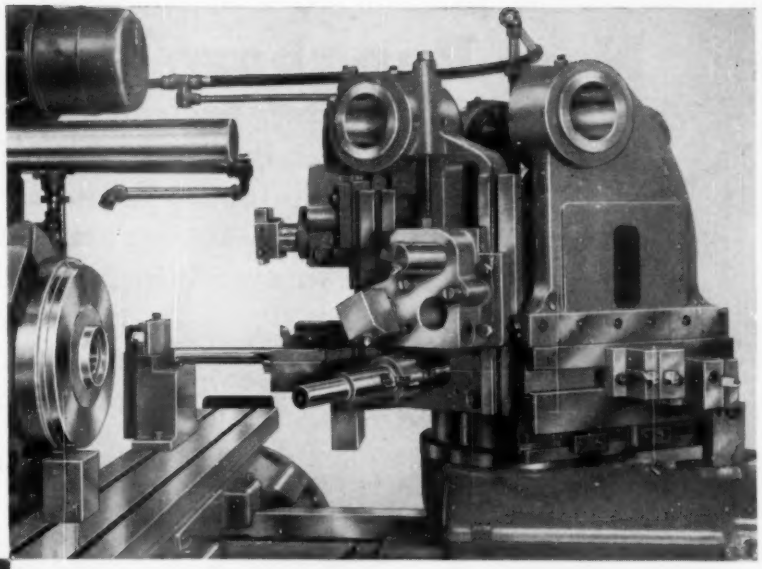

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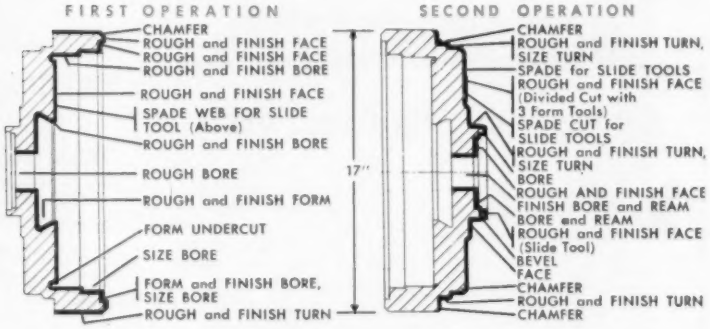

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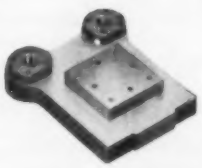

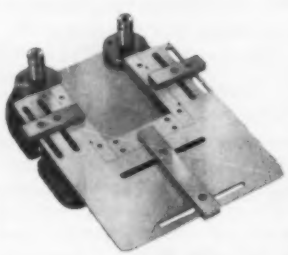

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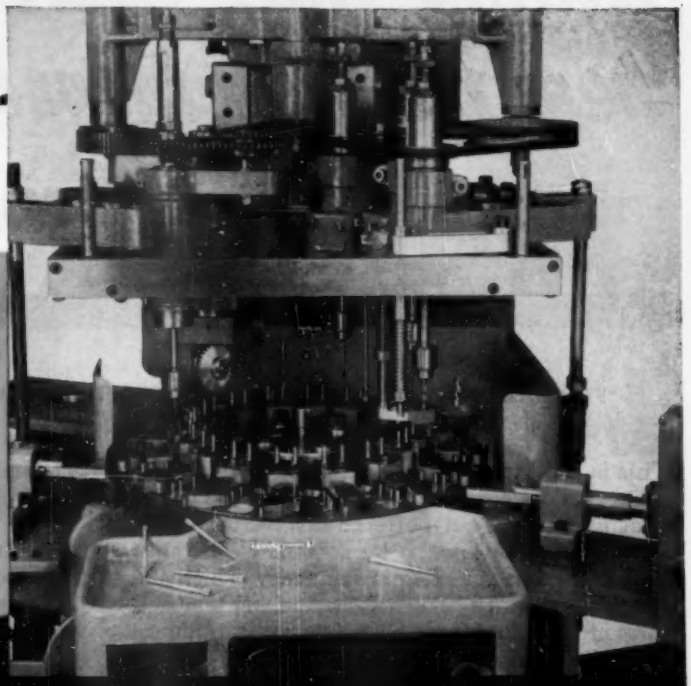
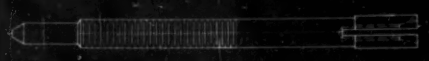
Bodine CASE HISTORY NO. 39

PROCESSING 3 PARTS
22 VARIATIONS
FOR
JOHNSON "SEA-HORSE"
OUTBOARD MOTOR





1. NEEDLE VALVE:

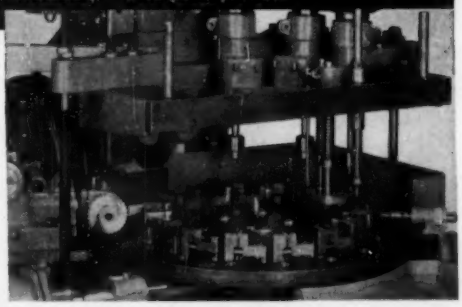
Drill hole 11/64" deep in top end. Countersink hole to 7/32" dia. 25° included angle. Mill .035" slot 11/64" deep down center, axis of hole, vertical milling spindle. Tap hole 6-32 NG-2 to 7/16" deep. Production 750 pieces per hour . . . in 11 lengths . . . 2½" to 4½".

2. HIGH SPEED NOZZLE:

(Vertical milling spindle removed; horizontal spindle substituted.) Seven different nozzles, 1 to 3 holes of different diameters produced. Meter holes drilled through one side and a hole T 11/64" deep in small end of nozzle. Mill 1/16" slot, 1/16" deep in top end of nozzle with horizontal milling spindle. Production, 1500 pieces per hour.

3. FLOAT VALVE SEAT:

Processed with 4 variations in the inside dia. of seat. Two I.D. diameters combination reamed to .004" (T.I.R.) concentricity with clamping dia. Valve seat rough and finish faced, depth tolerance .005". Mill 3/64" slot, 1/16" deep (horizontal spindle). Production, 1100 pieces per hour.



The three jobs detailed above are produced on the Bodine standard Model No. 41-20 . . . by means of a changeover of two horizontal indexing dials and sets of spacers for the variety of lengths of the needle valves.

All parts are hand fed, automatically positioned and clamped. The needle valves are automatically unclamped and unloaded by hand to protect the needle points. Other products are automatically ejected.

The installation of the vertical (photo above) and horizontal (photo at right) milling spindles with the other tools saved an extra handling on all three jobs.

All operations are held to close tolerances. Bodine offers 4 standard-size models which will perform Drilling, Tapping, Milling and Screw Inserting. Operations may be combined as required . . . or machines may be tooled for assembly only, with hopper feed and transfer mechanism for completely automatic production.

Bodine automatics will give you tomorrow's production today. Send us your tough problems . . . we may solve them to your competitive advantage.

Write Dept. TE-12 for the Bodine Case History Brochure.

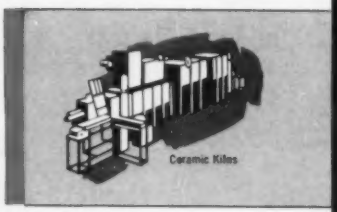
"You Can't Meet Tomorrow's Competition with Yesterday's Machine Tools"

THE
Bodine
CORPORATION
BRIDGEPORT CONNECTICUT

AUTOMATIC-DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

28D55

BRAND-NEW IDEA in heat treating furnaces



proving again . . .

FOR CARBONITRIDING, BRIGHT HARDENING, CARBURIZING OF SMALL METAL PARTS

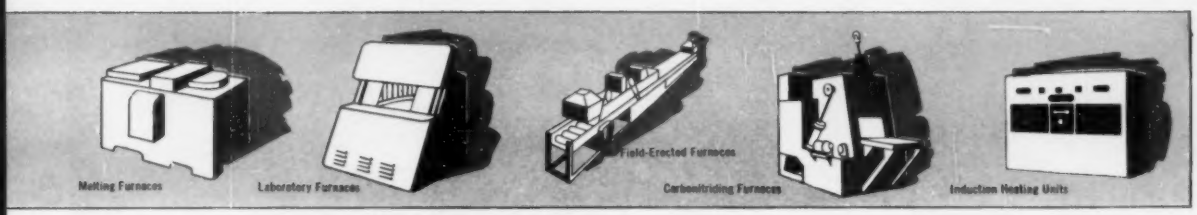
This is a completely new furnace, an exclusive Lindberg development. It is the first time induction heating has ever been offered in a heat treating furnace. No elements, no burners, no electrical or gas connections in it. Heating efficiency is high and the furnace can be brought to hardening temperatures in 17 minutes from cold. Temperature control is highly accurate, eliminating temperature override and lag for all practical purposes.

The Induct-O-Ring's circular shape eliminates door-opening heat and atmosphere losses and saves floor space. Work load is automatically charged and moved through the work chamber by a gentle, quiet, reciprocating movement of the furnace. The furnace is completely adaptable to automatic production processes, where its precise heat control, negligible maintenance and dependable operation are of particular importance.

- No elements, no burners
- No gas or electric connections in furnace
- Built like a fine machine tool
- Precise temperature control
- Very low maintenance
- Quiet, automatic, trouble-free

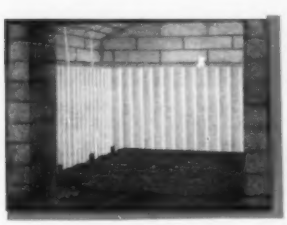
induct-O-ring*

*U.S. and foreign patents pending



. . it's better to talk it over with LINDBERG

If you are concerned with the application of heat to industry it makes good sense to talk it over with the most widely experienced experts you can find. We believe we have them here at Lindberg. Our only job is developing industrial heating equipment and we offer the most complete line in the field; heat treating furnaces, melting furnaces, high-frequency induction units, ceramic kilns; big ones, small ones, built in our own plant or field-erected. This gives us the experience and know-how to come up with something really new, like this revolutionary Induct-O-Ring furnace, time and time again. So take your industrial heating problems to the experts. Our engineers and technicians can have the right answer. Talk it over with Lindberg.



Another Lindberg achievement! The use of electricity in carbonitriding and carburizing furnaces has been made completely practical by Lindberg's recent development of the CORRTHERM electric heating element. This element is now being used in many furnace installations where ordinary electric heating elements could not operate successfully.

For fuel-fired furnaces, another important development, the famous "dimple" vertical radiant tube was created by Lindberg. This lightweight, easily-changed tube provides a big advance in furnace efficiency and effects a marked saving in operation and maintenance costs. Minimizes shut-downs and costs for tube changes.

Through the years Lindberg research and development laboratories have originated and perfected many other important heating processes, developments such as the Cyclone tempering furnace, automatic control of carbon potential in furnace atmospheres, 60 cycle induction melting and completely automatic ceramic kilns.

Many important Lindberg developments have come as a direct result of some good customer's need. With the customer's cooperation Lindberg engineers have frequently provided an answer to some pressing production problem. You will benefit, too, whether you need some specific Lindberg equipment or have an industrial heating problem that needs a solution if you'll just talk it over with Lindberg. Call your nearest Lindberg Field Representative. There's one (see your phone book) in every major industrial center.

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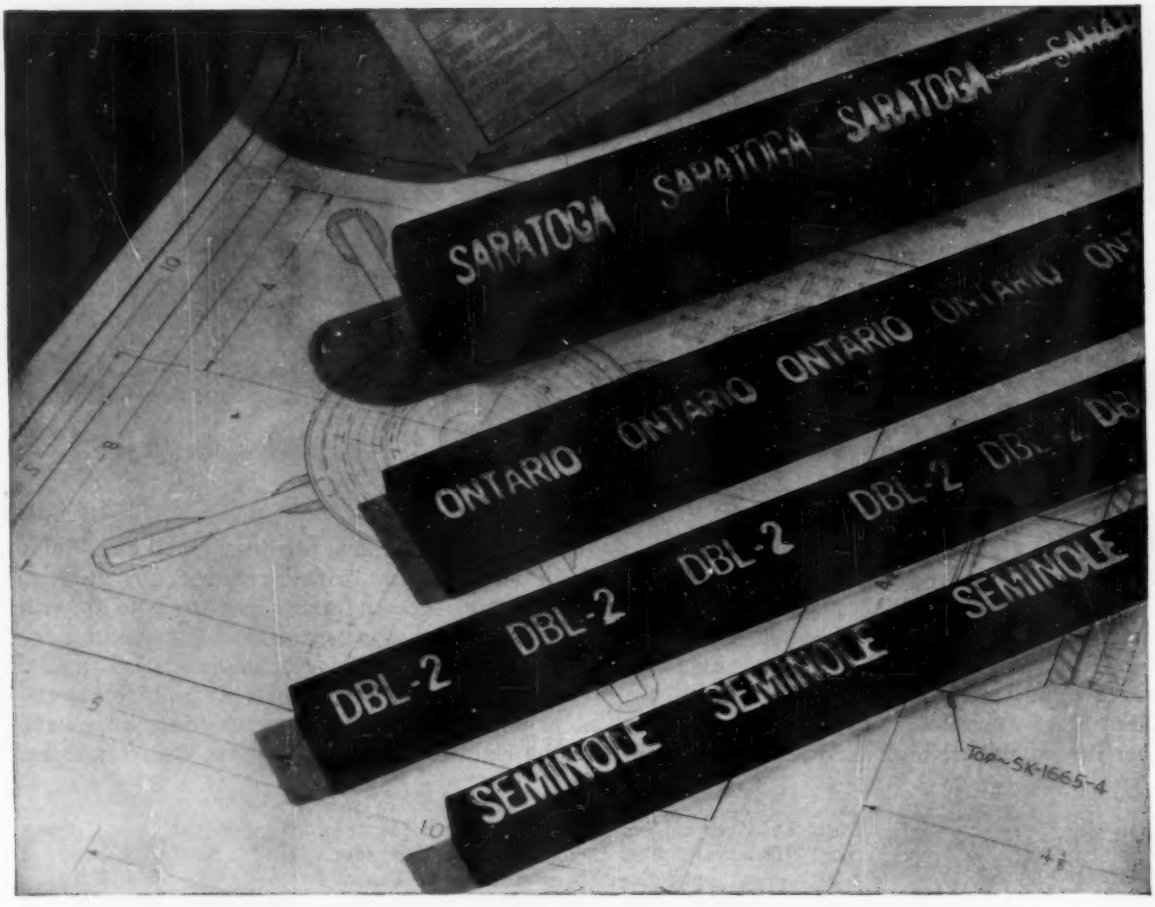
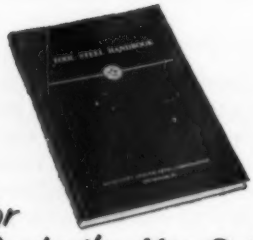
2447 West Hubbard Street, Chicago 12, Illinois
Los Angeles Plant: 11937 S. Regentview Ave., at Downey, Calif.

Associate Companies: Lindberg Industrial Corporation, Chicago • EFCO-Lindberg, Ltd., Montreal, Canada • Lindberg Italiana, Milan, Italy • The Electric Furnace Company, Ltd., Weybridge, Surrey, England • Etablissements Jean Aubé, Paris, France • Lindberg Industrie Ofenbau, Gross Auheim, Germany • Toyo Menka, Tokyo • Lindberg Engineering Company (Australia) Pty. Ltd., Melbourne



AL TOOL STEELS are *clearly* marked ... you can't mix up grades in your stock



For Production Men Only

"TOOL STEEL HANDBOOK"

We say "production men only" because this is a *work* book, not a picture book. It's a case-bound volume of 196 pages, packed full of technical data on the analyses, uses, handling and shop treatment of all grades of A-L Tool and Die Steels. Sent free, but ask for it on your company letterhead, please.

Address Dept. TE-84

"What's *that* piece?" . . . "Are you *sure?*" . . . In anybody's toolroom or stock racks, the best inventory or material identification system is apt to go haywire once in a while—and sometimes with grievous results.

But not when you're using tool steel grades produced by Allegheny Ludlum! Each length of AL Tool Steel is clearly marked with its grade name every few inches the entire length of the bar—*stenciled* in such a manner that the marking stays bright and clear, and can't be blurred or erased in handling.

Even a small crop end on a machine bench is readily identifiable—you can't go wrong. And that's only a small part of the benefit you can realize by using AL Tool Steels—available from stocks coast to coast. Let our Metallurgical Service go to bat on some of your tougher tool steel problems. ***Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pa.***

For nearest representative, consult Yellow Section of your telephone book.

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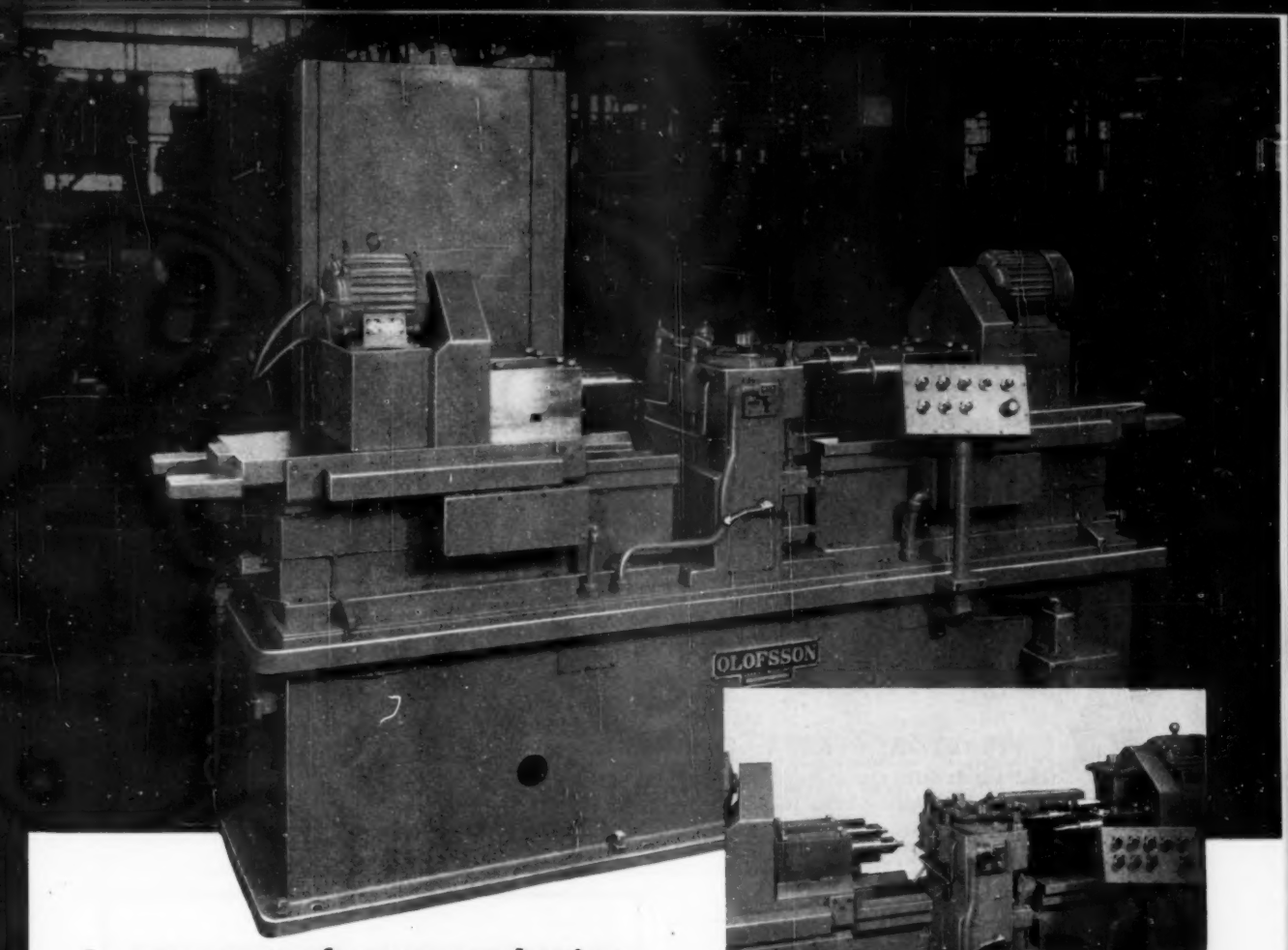
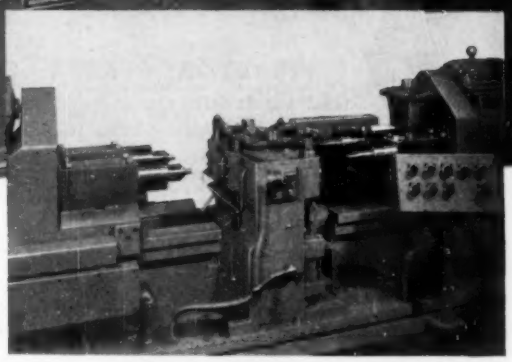
AL FINE TOOL STEELS SINCE 1864





Olofsson Two Station Precision Boring Machine arranged with Way Units. Conforms to J.I.C. electrical and hydraulic standards.

Is any part of your production COSTING TOO MUCH?

Today's competitive market demands constantly increasing production per man hour. Any machine tool which can't deliver that kind of production is too costly to operate. That's why an automotive manufacturer recently consulted with Olofsson engineers to increase production and lower unit costs on a boring operation. The result...

TYPE OF MACHINE—Olofsson Two Station Double End Precision Boring Machine arranged with Way Units.

WORK PERFORMED—Finish bore two holes, *in line,* simultaneously in cast iron differential cases.

RATE OF PRODUCTION—250 cases per hour.

MACHINE OPERATION—The operator loads the part into the nest and presses the clamp and start cycle button. Both units bore "in" simultaneously and rapid return to unload position. Hydraulically operated finger clamps release the part automatically when both units are in clear position. A manually operated elevator device is used to help insert and unload part from nest with ease.

Hand cycle provides additional retraction of spindles for setting or removal of cutting tools, also independent control of either unit.

Perhaps you have a tough production problem which can be solved efficiently and economically with Olofsson Special Machinery. You'll find it "pays to specialize with Olofsson".

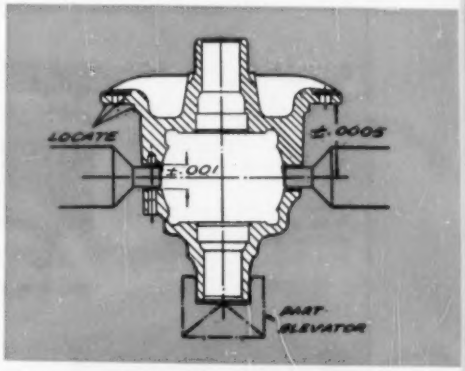


Diagram of differential case clamped into position for simultaneous, double-end precision boring operation.

Put the Olofsson Engineering Department to work for you. Write today. Or phone us at IVanhoe 4-5381, Lansing, Michigan.

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2730 Lyons Avenue • Lansing, Michigan

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. . . when VFC fed the production line one-half million parts per hour WITHOUT HANDS . . . . . INDUSTRY MARVELED!

Successful automatic production depends on the uninterrupted delivery of components properly positioned and perfectly timed. Engineering and feeder know-how will help you accomplish this better in the least possible time. VFC is an authority in small parts feeding . . . Better production through better parts feeding is their business. If you want to produce more, write, wire, or call VFC.

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Division of Automation Devices, Inc.

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Rear View With Plan File

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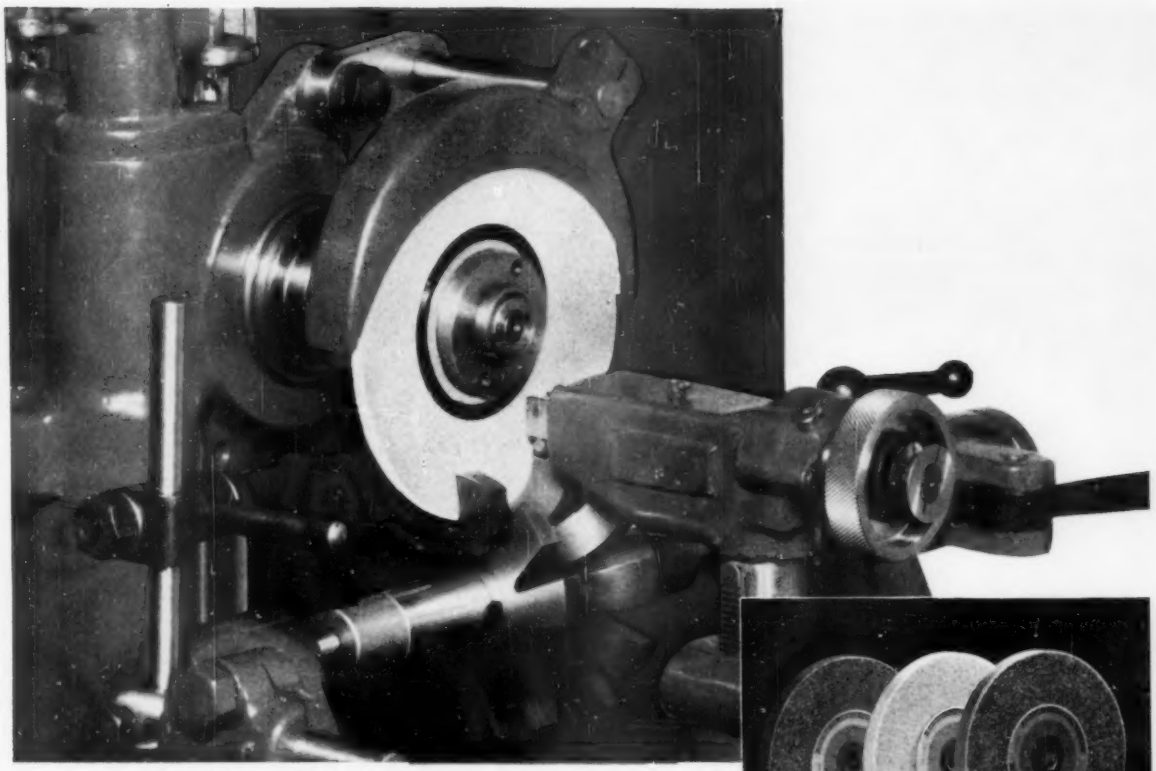
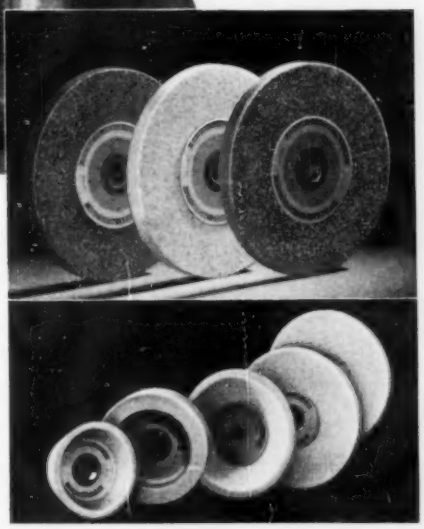


Sharpening formed cutter with Macklin V-6 Wheel



You can spark *your* production on every tool room grinding job with Macklin "Wheels of Profit". They stay sharp longer, cut faster and cooler. These precision performers include:

V-6 Wheels . . .
used principally to grind alloy steels of high tensile strength.

V-5 Wheels . . .
(silicon carbide). The popular choice to *economically* grind non-metallic, non-ferrous, and other materials of low tensile strength.

VMM Wheels . . .
(aluminous oxide or silicon carbide). The revolutionary new type wheel rated tops for precision grinding and finer finish.

FOR PROOF OF PERFORMANCE . . . READ THIS!

Operation . . . Surface grinding ends of carbide inserts in automotive plant.

		Here are the figures:	*WHEEL LIFE*
Production	**Wheel Cost**	Macklin 1" Wheel . .	60 hours
—Up 187%	—Down 50%	Competitors 1½" Wheel	32 hours

Macklin wheel was faster cutting, required no dressing, and user states, "It was possible to eliminate several diamond operations."

TRY MACKLIN WHEELS ON *YOUR* NEXT JOB . . .
A trial will convince you.

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- Control Torque—Control Noise.
- Completely disengage the instant the fastener is run to desired tightness.
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with QUICK TRIGGER RELEASE

for faster work-holding

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***What* TO DO ABOUT SPOILAGE LOSSES!**

On tapping and reaming jobs, when spoilage losses get out of control because of misalignment of the work with the spindle, you will find that the trouble can often be eliminated by changing over to Ziegler Tool Holders.

With the Ziegler a faulty set-up is automatically corrected, even though it amounts to as much as 1/32" on the radius or 1/16" on the diameter. As a consequence, it is only in cases of extremely great inaccuracies in set-up that spoilage losses can occur.

Save yourself grief on tapping and reaming jobs by always using Ziegler Tool Holders!

PROMPT DELIVERY

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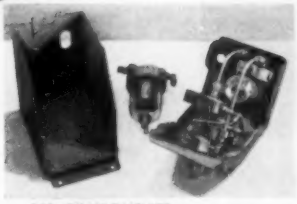
WITH THE SAME BASIC, *NO-DRIFT* SYSTEM

ONLY AIR GAGE WITH BUILT-IN ACCURACY THAT ENABLES USE OF ONE MASTER

BETTER FILTER with TRANSPARENT BOWL

New sintered bronze element filters out dirt and coagulated oil. Condition of air lines can be readily checked by observing filter bowl. Attached directly to gage, it eliminates extra piping.



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Now, new important refinements have been built into the Dimensionair which further improve its use.

Most air lines installed in plants were NEVER INTENDED to be used for precision instruments of any kind. Hence, the Dimensionair is now made EVEN MORE IMMUNE to unclean air and variations in air pressures.

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Smaller size makes the gage EASIER TO HANDLE and increases its adaptability for general use . . . and for multiple use.

Since any instrument is subject to all degrees of treatment it must be EASY TO SERVICE when the unusual or unexpected upsets its normal function. In the new and smaller Dimensionair all components and connections are quickly and easily accessible.

In every way the Dimensionair provides you with constant accuracy and GREATER DEPENDABILITY, adaptability and service. That's why more and more inspection people buy it. Why don't YOU try it? Write or call us or our nearest office.

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New Major Developments

from Henry & Wright and V & O Press

. . . for extending economics of progressive stamping

. . . for faster, safer feeding with geared presses

NEW HENRY & WRIGHT Double-Crank DIEING MACHINES

Here's a new H & W development designed to reduce the unit cost of metal stampings. Engineered to bear loads encountered in long progressive dies while maintaining precision registration of punch and die, H & W's Double-Crank assembly also offers you greater flexibility in ratio of die bed to press capacity. Thus you can: (1) form larger parts with lower capacity machines than before possible; and (2) handle stampings requiring high pressures with greater precision and longer die life than before. Special features of the new H & W Double-Crank machines include:

NEW V & O One-to-One FEED-O-MATIC

Now you can equip your geared pneumatic clutch presses with V & O Feed-O-Matics and gain all the advantages of precision automatic feeding — increased production, greater personnel safety, and precision quality control. The Feed-O-Matic for geared presses is driven directly from the drive shaft on a one-to-one ratio. Mechanical "fingers" of the Feed-O-Matic lift parts up, over and into the die for precise placement. High cost tools can be used with less fear of breakage and stop motions are eliminated. Write today for complete information.

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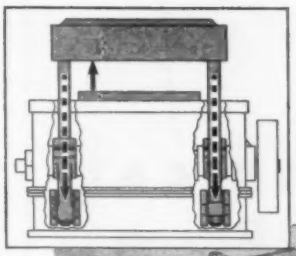
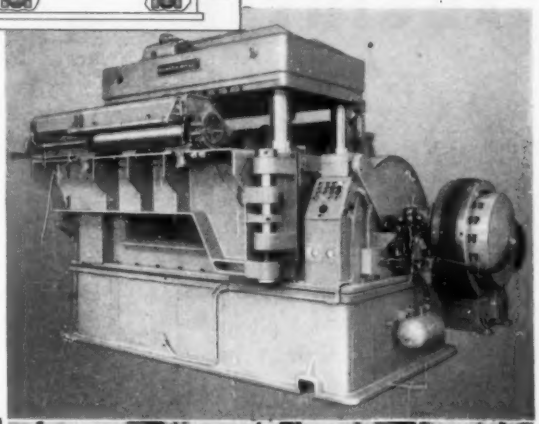
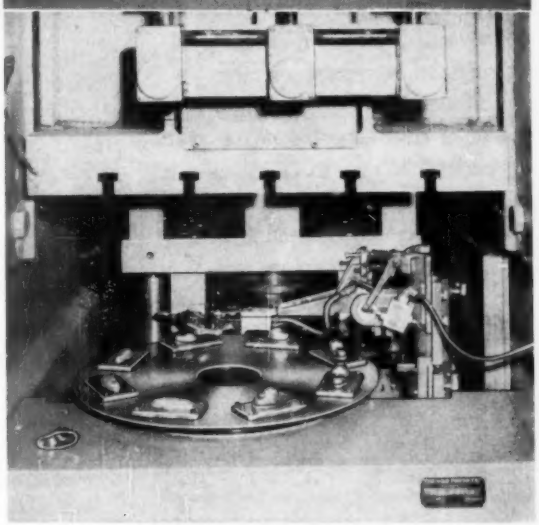


New 350-Ton Dieing Machine. Insert drawing shows advantages of new Double-Crank assembly.

(1) Completely enclosed to prevent chips, slugs, stock lubricating compound and other foreign matter from entering and damaging working parts; (2) A self contained recirculating lubrication system; (3) Large area chutes at front and rear for disposal of finished parts, scrap slugs and installation of stackers; (4) Swing-out type roll feed, solidly supported on knees when in operation; (5) Roll feed driving mechanism completely enclosed; and (6) Crosshead adjusting mechanism is conveniently located within the upper crosshead for easy accessibility. Write today for complete details.





The Feed-O-Matic® is simple and self contained, well enclosed, but highly accessible for servicing.

Behind each Henry & Wright - V & O representative are two engineering organizations geared to work out problems ranging from simple blanking to automated "packaged" presses. He will fit into your production planning team like the "pro" he is . . . adding his experience to yours in terms of your requirements.

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1000
~~400 sfpm~~

depth of cut-.125~~.005~~

1250
sfpm-~~800~~

"~~un~~machinable"

2000
~~250 sfpm~~

65
pieces per hr.-~~20~~

1175
SAE 1035-~~250 sfpm~~

505
HS-Steel-~~90 sfpm~~

4
min. per cut-~~40~~

you can scrap your ideas of cutting-tool performance . . .

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introduces a NEW ERA!

The figures above show the amazing improvements in production obtained through the use of STUPALOX sintered oxide cutting tools in place of tools previously used. Actually the figures are conservative, because tool performance in many cases was limited by inadequate power and rigidity of the machine tool.

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HANDY PACKAGE — *contains ten inserts*

This compact plastic box provides a practical container for ten Stupalox sintered oxide inserts.

STUPAKOFF DIVISION OF
The CARBORUNDUM Company
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the finest high production lathes

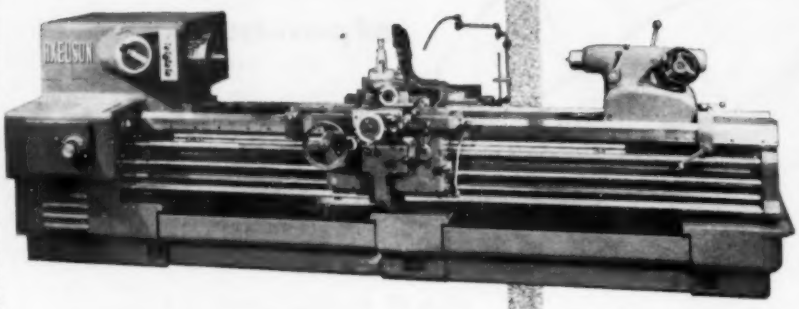

Photo courtesy
Axelson
Manufacturing Co.

Axelson's new 25/16 heavy-duty engine lathe is designed to increase production, reduce turning time and simplify operator control. It features 40 h.p. over 32 spindle speeds, a single lever hydraulic speed selector; 66 feed combinations, exclusive 5-position diameter cross-feed disconnect stop and 7-position longitudinal power-feed disconnect stop. For more information, write Axelson Manufacturing Co., 6160 South Boyle Ave., Los Angeles 58, California.

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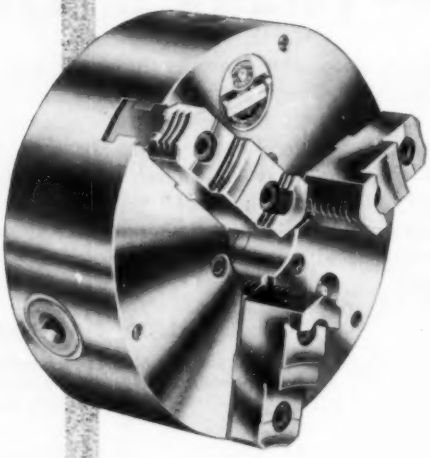
This is Horton's standard 3-Jaw Scroll Universal Chuck which has contributed to Horton's reputation for chuck leadership for over 100 years. Its precision and lasting accuracy make it a must in any production picture. For the complete story on the complete line of Horton Chucks, see the Horton people in your area now.



HORTON Since 1851 CHUCK

HORTON CHUCK DIVISION
GREENFIELD TAP AND DIE CORPORATION
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HIGH QUALITY*

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* *High quality* and *good service* are apt words to describe what you get when you buy tool and high-speed bar stock from *Jessop Steel*. Descriptive in the past—even more so today! For, during the last year, Jessop has greatly expanded its laboratory facilities for closer *quality-control* and radically adjusted its warehouse product-mix for *faster service*. Whether you buy bar stock, or any of the other products shown below, you'll find profit in sending your next order to *Jessop Steel*.

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in the plant of

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RADIAL-SENSITIVE-UPRIGHT DRILLS
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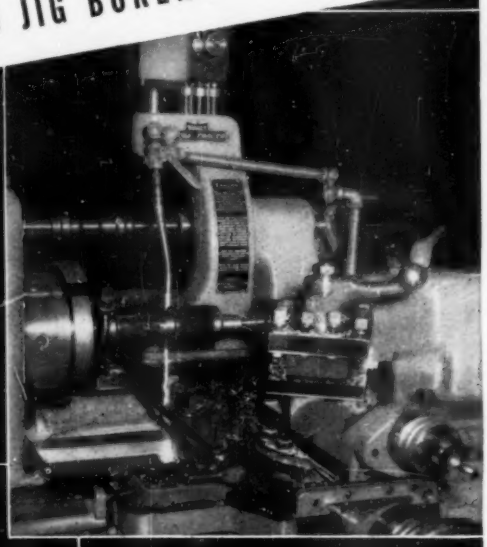
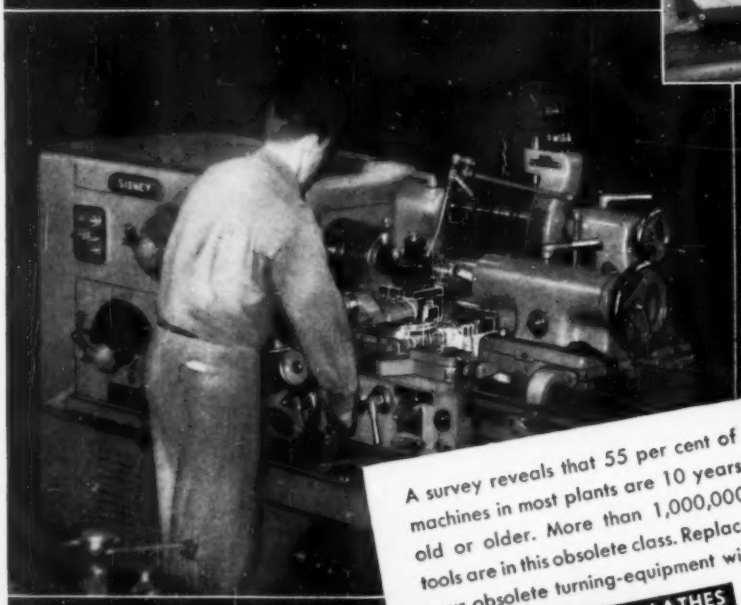


Here's what Fosdick thinks about Sidney Lathes:

"This Sidney Lathe with tracer attachment has been very satisfactory, resulting in considerably reduced production time and, at the same time, holding closer tolerances."

Note how simply and economically the SIDNEY FLUID TRACER reproduces any type of work in any quantities desired . . .



THE TRACER HEAD FOLLOWS ALONG A TEMPLATE OR MASTERPIECE AND THE WORK IS DONE WITH ACCURACY OF UTMOST FIDELITY . . . QUICKLY.

A survey reveals that 55 per cent of machines in most plants are 10 years old or older. More than 1,000,000 tools are in this obsolete class. Replace your obsolete turning-equipment with

MODERN SIDNEY LATHES

THE SIDNEY MACHINE TOOL COMPANY
over 50 years
of service to
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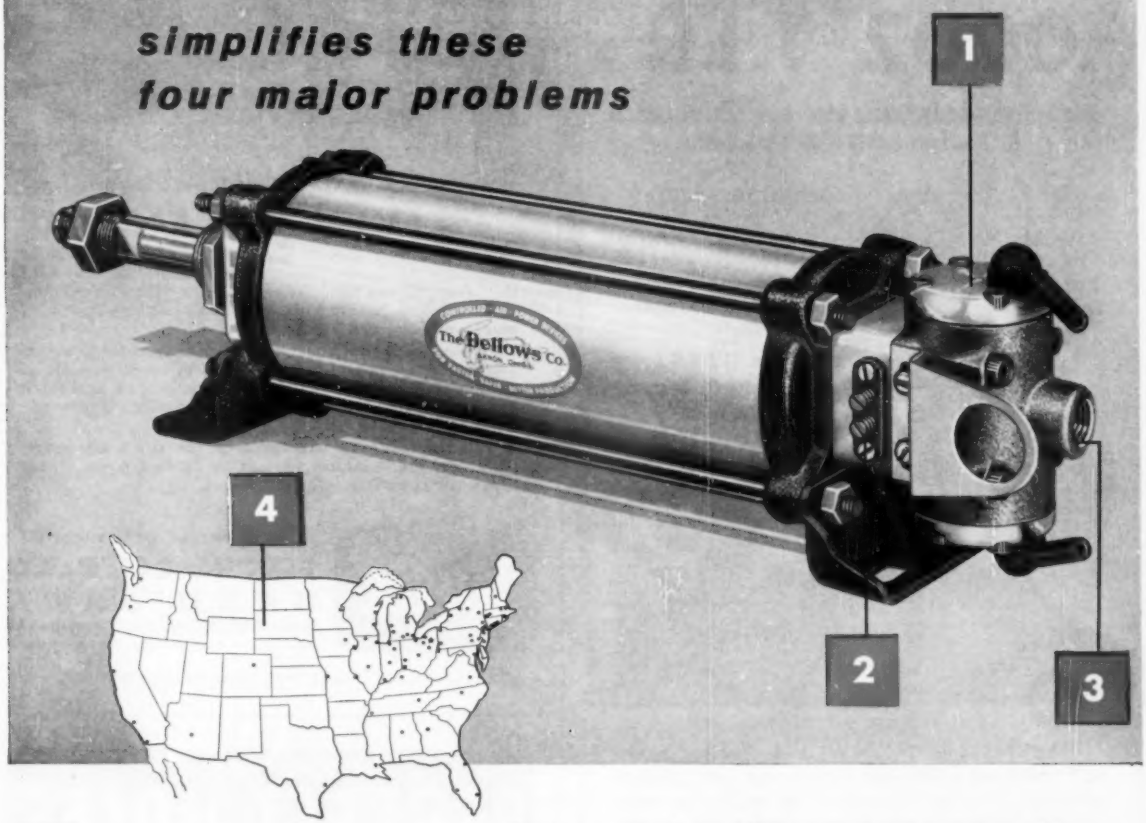
THE Bellows AIR MOTOR

simplifies these four major problems



1 **Built-in electrically controlled directional valve, either 8 or 110 v., simplifies design problems.**

2 **Built-in speed controls for accurate regulation of piston rod speed simplify control problems.**

3 **The single air connection, which can be made with flexible air hose, simplifies installation problems.**

4 **More than 125 Bellows Field Engineers in the United States and Canada simplify service problems.**

Design, control, installation and service are problems every O.E.M. Design Engineer faces when selecting components for automation.

In pneumatic design, the Bellows Air Motor—the air cylinder with the built-in valve—simplifies his problems. Instead of separate valving for directional control, separate valving for speed control, multiple mounting, complex and cumbersome piping for air supply—he works with one compact, complete power unit.

Not only are design and control simplified when you specify "Bellows", but installation costs are less; and you know wherever your machine is shipped, a Bellows Field Engineer will be available for service if it is ever needed.

Write for Bulletin BM-25
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ACCURACY .0002 T.I.R.

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MODEL B943 MOTOR DRIVEN WORK HEAD

No. 11 B & S Tapered Spindle Standard Equipment. No. 12 B & S or No. 5 Morse Available at Slight Extra Cost.

The B943 Motor Driven Work Head is a compact self-contained power unit for internal and external grinding. It is held in position by two T-slot bolts and can be mounted at any convenient spot on the table. The swivel base, which is graduated 90° one side of center and 45° on the other, permits the Work Head to swivel full 360° if desired. Swivel base can be easily removed from head permitting units to be mounted on table without base if desired. The B943 is easily and quickly mounted on other makes of grinders.

The No. 11 B & S tapered spindle, mounted on ball bearings, is hardened and ground, and is designed to receive chucks, collet fixtures, face plates, straight or tapered sleeves, centers and like equipment. Unit is grease packed at factory and requires no service in the field for the life of the bearings. Streamlined in design, this fixture is quickly mounted and is easy for the operator to keep clean.

The special motor is provided with conveniently located reversing switch which is handy for the operator regardless of the position of the work table or rotation of the work. Motor operates quietly and is fully protected from dust and from any oil entering from working parts.

See this extremely accurate B943 work head at your equipment dealer or write for complete literature.

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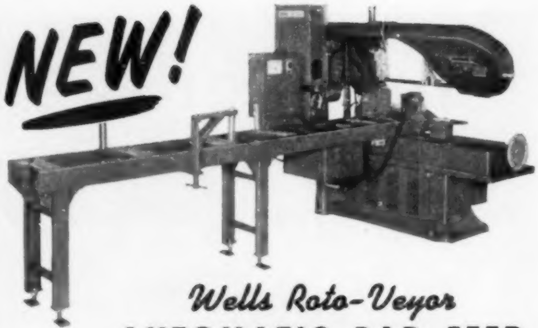

Wells Roto-Veyor

AUTOMATIC BAR FEED

The Wells Roto-Veyor is an entirely new concept in automatic bar feeds. Designed specifically for use with the Wells Model 1200 Band Saw, the Roto-Veyor converts it into a heavy duty completely automatic cut-off machine.

All conveyor feed rollers are mechanically powered —electrically controlled. The Roto-Veyor is capable of unlimited projection length. Feed mechanism and stock clamping action is synchronized with the saw to provide accurate repetitive cutting.

The Roto-Veyor will improve the saw's efficiency, save time, and reduce production cutting costs. *Write today for complete information.*

Wells SAWS

Wells ®

The Pioneers of Horizontal

METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION

600 Service Road • Three Rivers, Michigan

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Rotary Broaches Produce PERFECT HOLES

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- A NEW INVENTION!
- A NEW MACHINING METHOD! ROTARY BROACHING*
- A NEW NAME-"ROTARY BROACH"*

ROTARY BROACHES may be used in lathes, turret lathes, automatics, drill presses, etc., to replace reamers. They produce perfect holes with finishes that can only be compared to honing. They last longer before grinding is necessary and may be resharpened 10 to 30 times. They produce perfect holes at a fraction of the cost of those produced by other methods. Eliminates grinding, lapping, honing and boring.

USE THIS NEW MACHINING METHOD—ROTARY BROACHING*

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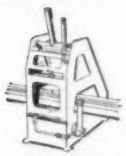
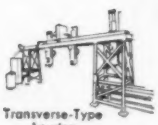
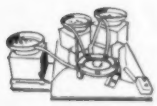


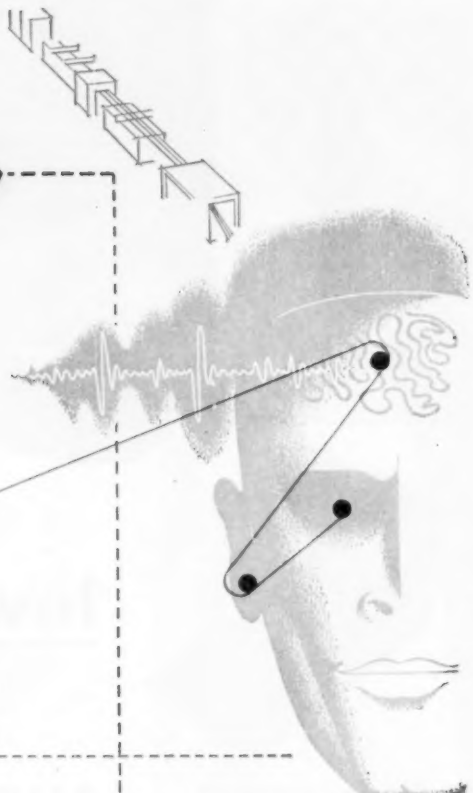
Probe-Type Inspection Machine



Transverse-Type Loader



Metal Fastener Assembly Equipment



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1 For new production line methods calling for either automatic or semi-automatic operations, you'll find at Barnes an experienced engineering staff to work with you. Detailed plans and proposals will be submitted for your consideration and can be depended upon to give you the latest in automation ideas and the very best of proven mechanical, hydraulic, and electrical actuation methods. Ask for a survey early in your planning program.

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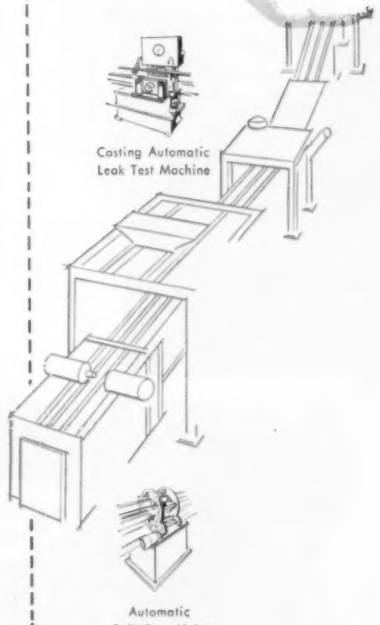
Find out today why more and more Production Executives are turning to Barnes for a practical solution to their automation problems. We will be pleased to analyze your requirements, offer recommendations, and submit a cost estimate in a formal proposal if you so desire.



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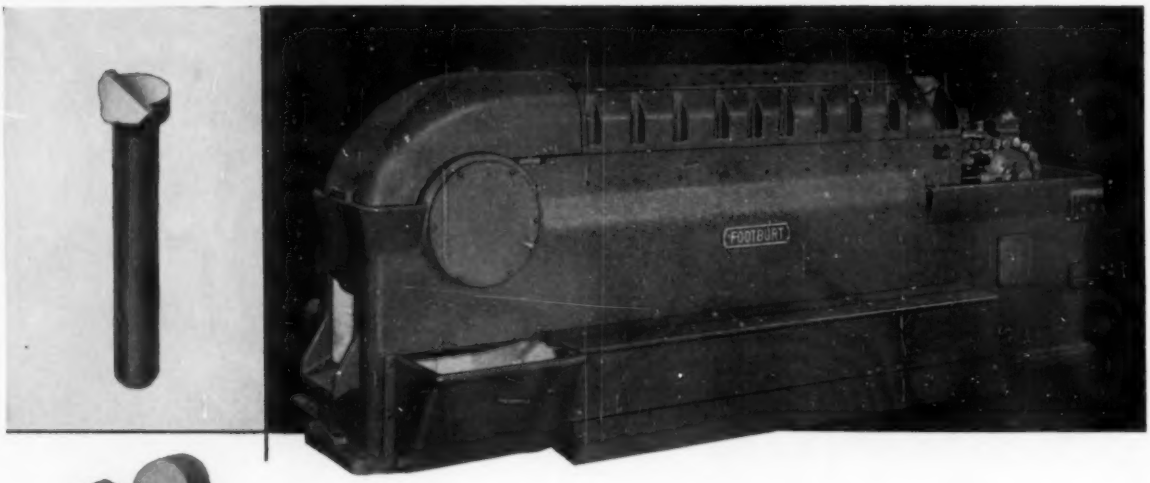

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■ In many plants where large quantities of duplicate metal parts are being machined, substantial savings are being made through the adoption of surface broaching. Production is exceptionally high, close tolerances are maintained, and tool maintenance costs are much lower than with ordinary methods. Foote-Burt engineers, pioneers in this advanced machining method, have had a wide experience in applying surface broaching, in many fields.

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Engineered for production

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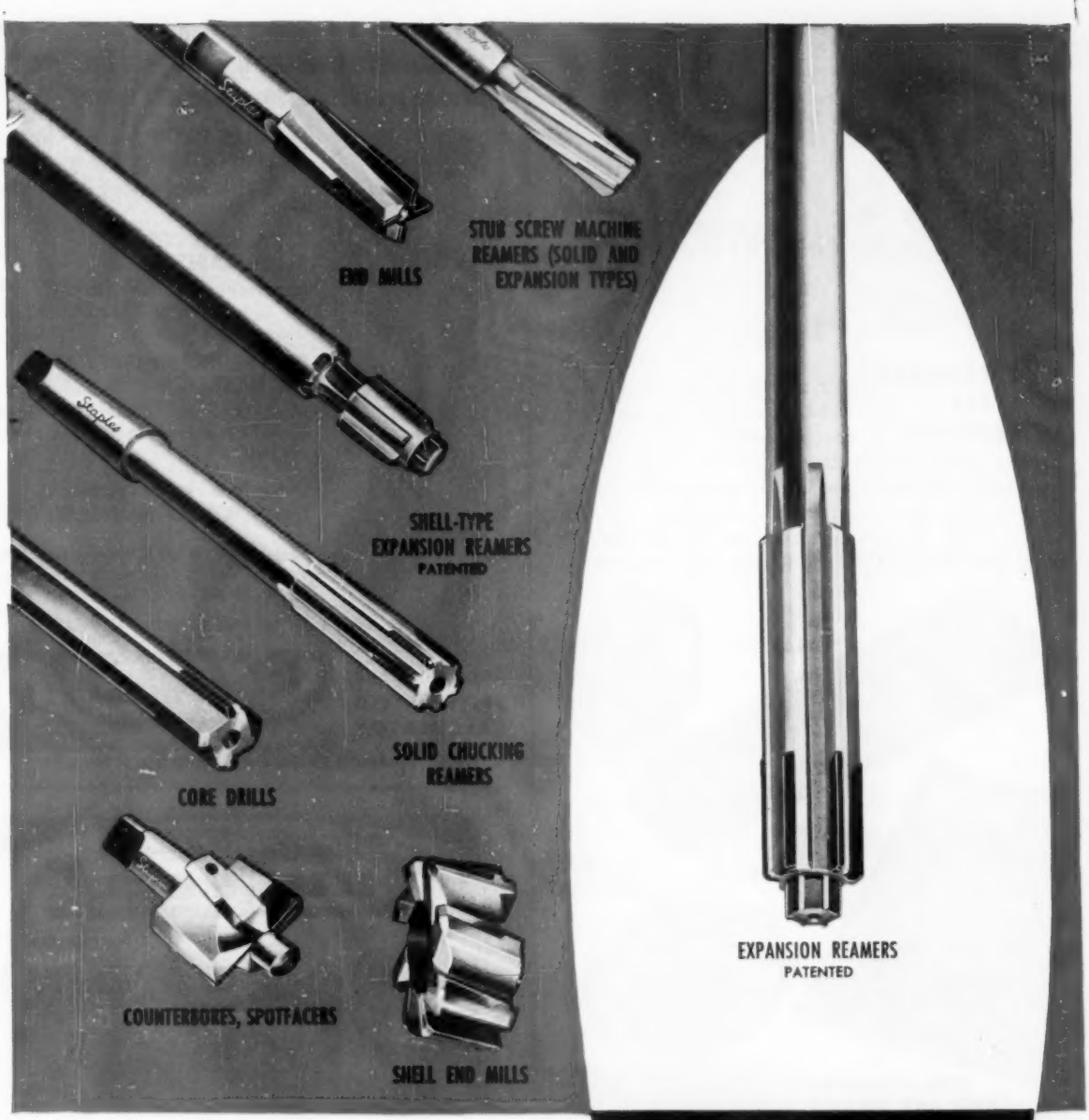
PIONEERS IN SURFACE BROACHING



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THESE 40-TON PRESSES
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Significant savings may result if you let our engineering staff assist you. There is no obligation.

Rousselle Presses are sold exclusively through leading machinery dealers.

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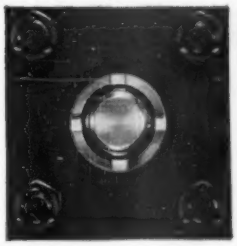

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This ad is written for the man who has thought all cylinders are "pretty much alike." That just isn't so, and your Hannifin man would like an opportunity to show you why...

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We think you'll agree that it pays to standardize on Hannifin cylinders.

AIR AND HYDRAULIC

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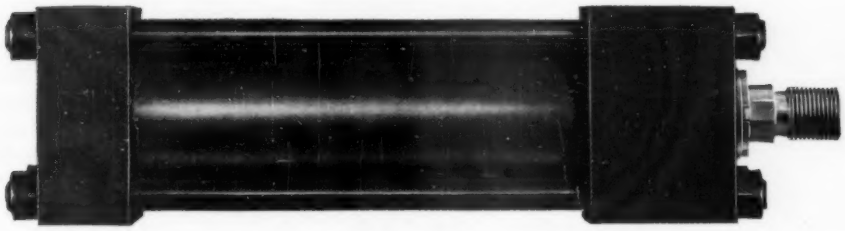
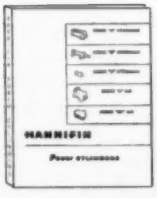
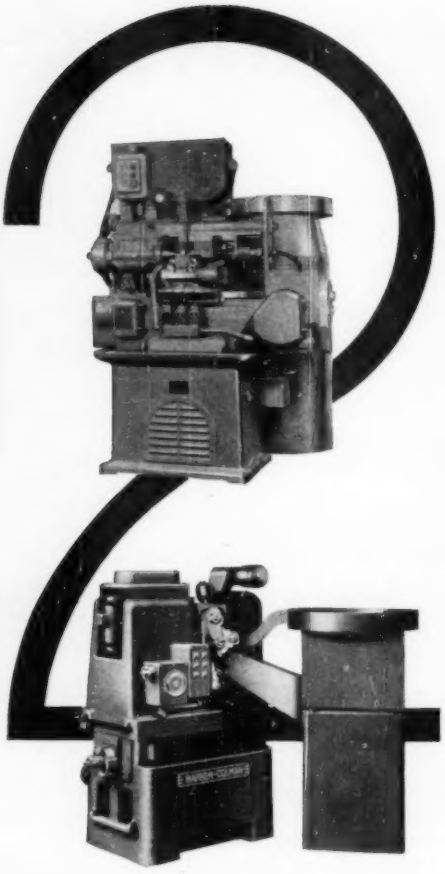


COMPLETE CYLINDER FILE

Write for your copy of this new Hannifin Cylinder File . . . complete, easy-to-use, easy-to-order-from information on five lines of Hannifin Cylinders. Write Hannifin Corporation, 519 S. Wolf Road, Des Plaines, Ill.



it takes top equipment to cut the best gears



BARBER-COLMAN offers

Superior Hob Accuracy

As a result of long experience and skill in hob manufacture, Barber-Colman offers a new concept of ultra-precision in hob tolerances. An example is a 48 DP Class AA hob, ground to total allowable lead variation of .00015" tooth-to-tooth, .00015" in any one axial pitch, and .0003" in three axial pitches. Tolerances such as these are only practical where machine and hob sharpening have equally close tolerances. We suggest you contact our engineers for recommendations when you have jobs requiring hobs of this accuracy.

For production hobbing, Barber-Colman makes Class A, Class B and Class C hobs. Classes A and B are ground on the form and are recommended for accurate finishing and semi-finishing. Class C Accurate Unground hobs are used primarily on preshaved gears. All hobs are well within the standard tolerances for their particular class and pitch.

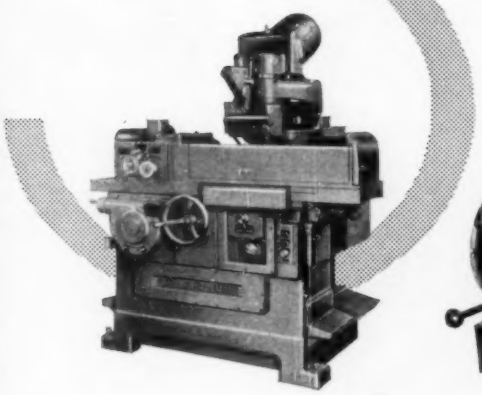
Automated Gear Production

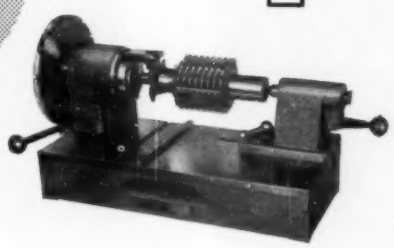
For high speed, mass-production gear problems, Barber-Colman engineers have developed fully automatic hobbing machines, including magazine or hopper-feed loading, fully automatic cycle and automatic hob shifting.

For maximum production of specific parts, machines are designed with special purpose tooling, loading, gaging and handling to suit the requirements for accuracy and finish. Such machines may also include inspection, rejection, and size-gaging as part of the automatic cycle.

General purpose hobbing machines are available for hobbing parts up to 16" diameter, from 3½ DP to the finest pitches. A variety of special tooling can be furnished — hydraulic, pneumatic, electric — to give maximum accuracy and production efficiency for the particular problem.

345





Controlled Hob Sharpening

The inherent accuracy in Barber-Colman hobs and hobbing machines may be upset if all factors are not in adjustment. A common cause for loss of accuracy is error in resharpening hobs. To provide positive sharpening control on a production basis, and to insure maximum accuracy in sharpening, Barber-Colman engineers have developed a series of automatic sharpening machines. With these machines the sharpening operation becomes simple, fast and convenient, and original tool accuracy is easy to maintain.

Hob Sharpening Inspection

The Barber-Colman Hob Sharpening Checker is a precision instrument for measuring the accuracy of face sharpening on straight and helical fluted hobs. The precision found in Barber-Colman hobs is inherent and the only place it can be lost is in the sharpening operation. Reasonable in cost, this checker furnishes a convenient method for checking the sharpening accuracy.

Gear Cutting Service

Barber-Colman hobbing engineers, backed by years of experience in the field, and special skills acquired in production hobbing of gears, are available without cost to analyze and make recommendations on gear problems. This service will help to maintain peak efficiency in your gear cutting operations. Send us inquiries about accuracy, tooling, production and special toothforms.

BARBER-COLMAN COMPANY

6312 ROCK STREET • ROCKFORD, ILLINOIS

Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN

PRECISION PERFORMANCE...

To this skilled artisan, precision performance means duplicating in miniature the graceful lines of a former romance-laden queen of the seas.
To tap users, precision performance means production-line continuity, better threaded parts, increased tap life . . . and BAY STATE!

Bay State Tap & Die Company

Mansfield, Massachusetts

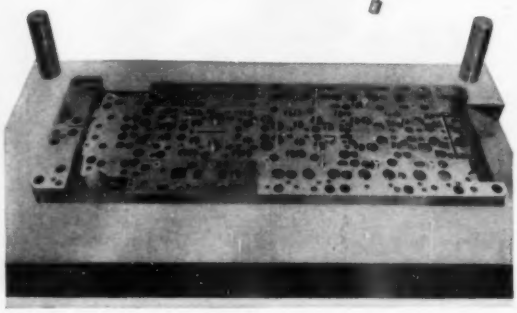
On the shelves of your local Industrial Supply Distributor

BAY STATE TAPS

USE READER SERVICE CARD; INDICATE A-12-246-1

HOLES JIG GROUND with *Vulcanaire*

Provide yourself with this inexpensive* instrument for use on your present equipment and JIG GRIND with a guarantee.



A seven station die from Vulcan's contract Tool Room (Your Tool Room in Dayton).

Standard sized punches and buttons were used. But since forming and piercing operations were involved, hardening of the sections was necessary followed by JIG GRINDING. Result: Close tolerances held easily and perfect progression throughout — another satisfied customer.

*Vulcanaire equipment pays for itself on the first job.

Borrow Vulcan's instructive movie on jig grinding

SERVICES OF

YOUR TOOL ROOM in DAYTON

Engineering, Processing, Designing . . . Special Tools . . . Dies . . . Special Machines . . . Vulcamatic Transfer Machines . . . Automation . . . including the Vulcan Hydraulics that Form, Pierce, Assemble and Size . . . Vulcanaire Grinding Heads . . . Motorized Rotary Tables . . . Plastic Tooling . . . Vulcanaire Jig Grinders.

VULCAN TOOL CO.

7300 LORAIN AVE. DAYTON 10, OHIO

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McKay

High Production Draw Benches

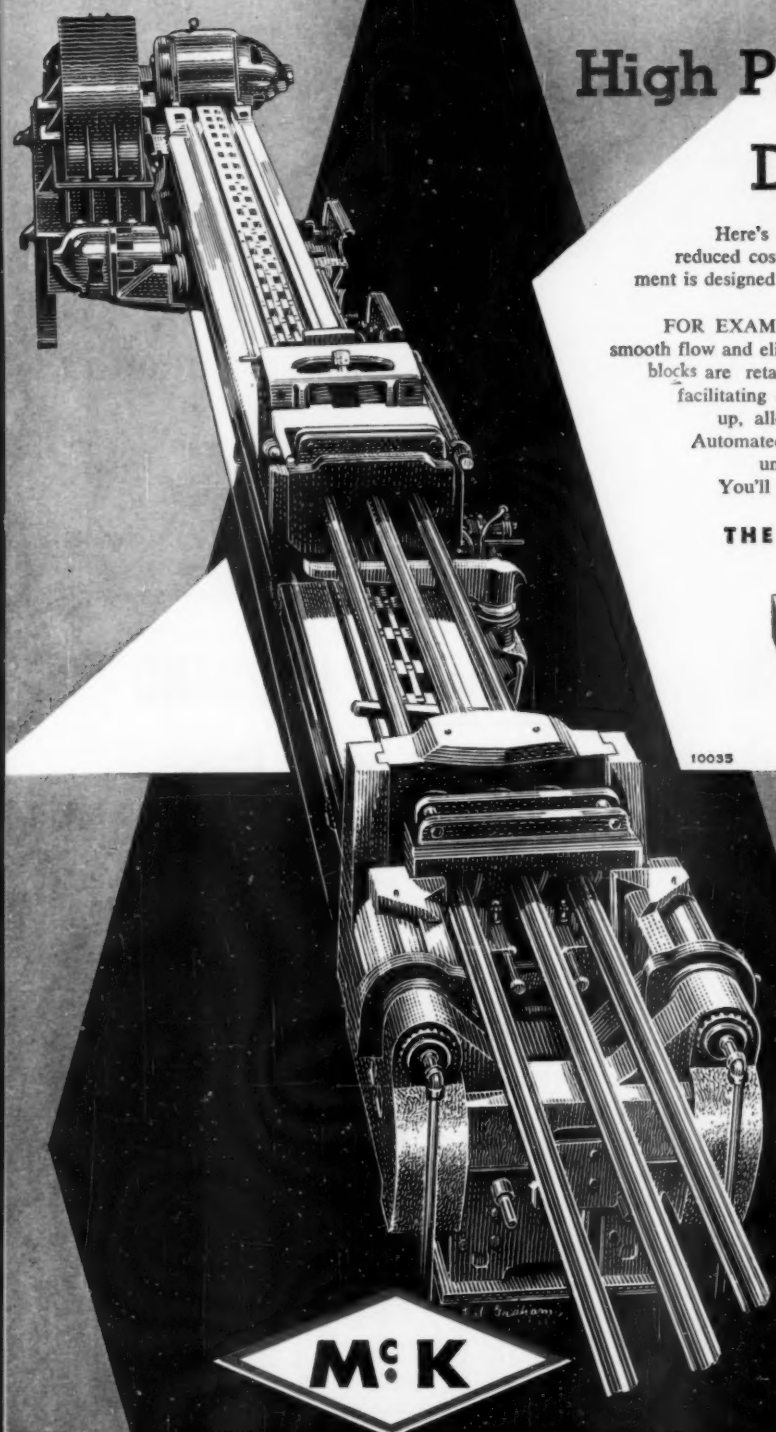
Here's greater cold draw production at a substantially reduced cost! McKay's line of rugged, precision built equipment is designed to meet and exceed today's accelerated demands.

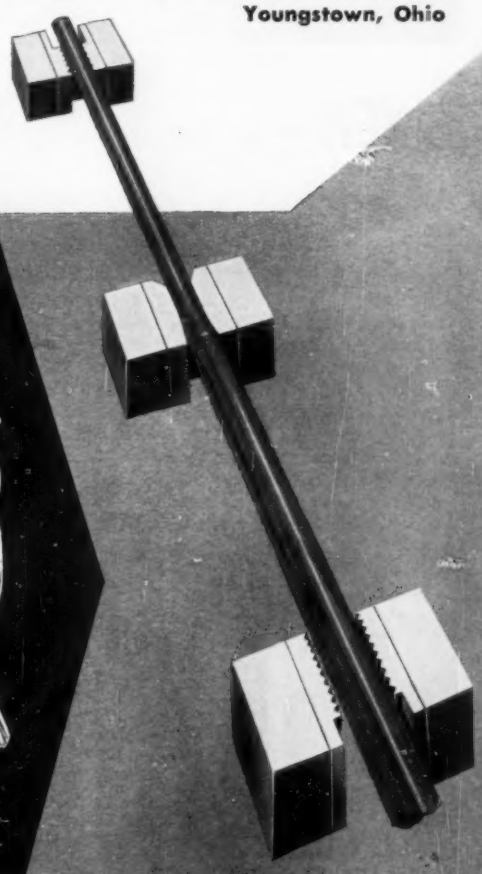
FOR EXAMPLE; Integral, centerline push pointing provides smooth flow and eliminates a costly operation. Die blocks and pusher blocks are retained in machined ways, eliminating bolts and facilitating change over. Carriage return speeds are stepped up, allowing more productive time in the draw cycle. Automated lines are possible merely by addition of standard units already proved and in operation.

You'll profit by calling a McKay sales engineer.

THE McKAY MACHINE COMPANY

Youngstown, Ohio

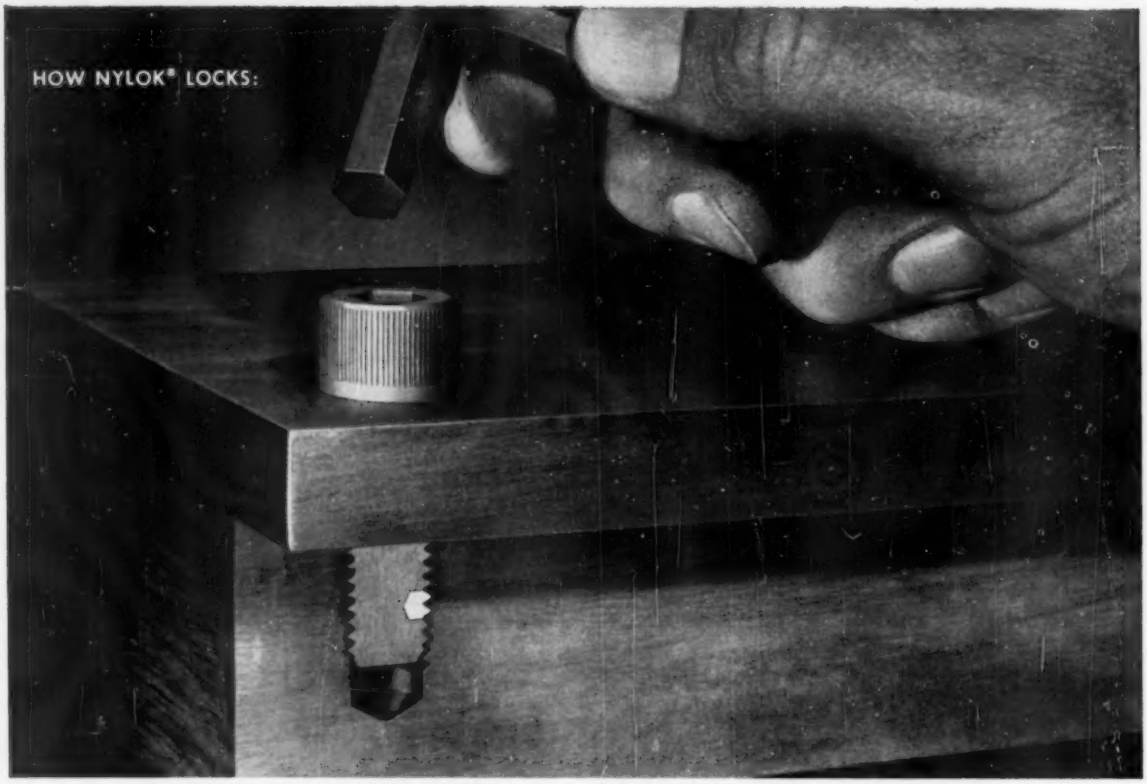




10035

McK

SETTING THE STANDARDS OF QUALITY METAL WORKING MACHINES FOR TWO GENERATIONS



LOCKED! The tough, resilient nylon pellet keys itself into the mating threads. It forces threads together, and locks the screw securely.

NEW—a complete line of self-locking UNBRAKO socket screw products that won't work loose

They simplify design and save production time

UNBRAKO socket screws are now available embodying the Nylok* self-locking principle. Nylok provides a truly practical new solution to the problem of making screws self-locking.

You save production time when you build products with self-locking UNBRAKOS. And you get greater simplicity in design with less bulk and weight. The number of parts you must assemble to achieve full locking action is reduced to the absolute minimum. Lockwashers under screw heads are no longer necessary. Costly wiring of cross drilled heads is eliminated. So are cotter pins and complex multiple set screw installations.

Self-Locking UNBRAKOS are completely reusable. They have uniform locking and installation torques—with no galling or seizing on mating threads. They successfully withstand temperatures from —70° to 250°F. And, on properly seated screws, the pellet acts as a liquid seal.

Self-locking UNBRAKO socket screws come in a complete range of standard sizes and materials. See your authorized industrial distributor. Technical data and specifications are detailed in Bulletin 2193. Write us for your copy today. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 37, Pa.

*T.M. Reg. U.S. Pat. Off., The Nylok Corporation

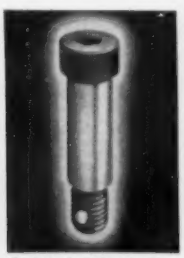
UNBRAKO SOCKET SCREW DIVISION

STANDARD PRESSED STEEL CO.

SPS

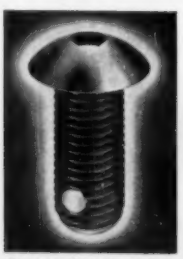
JENKINTOWN PENNSYLVANIA

Socket head cap screws. Standard sizes #6 to 1 in.

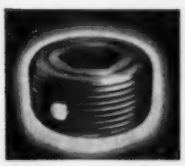


Socket shoulder screws. Standard sizes ¼ to ¾ in.

Flat head socket screws. Standard sizes #6 to ¾ in.



Button head socket screws. #6 to ⅜ in.

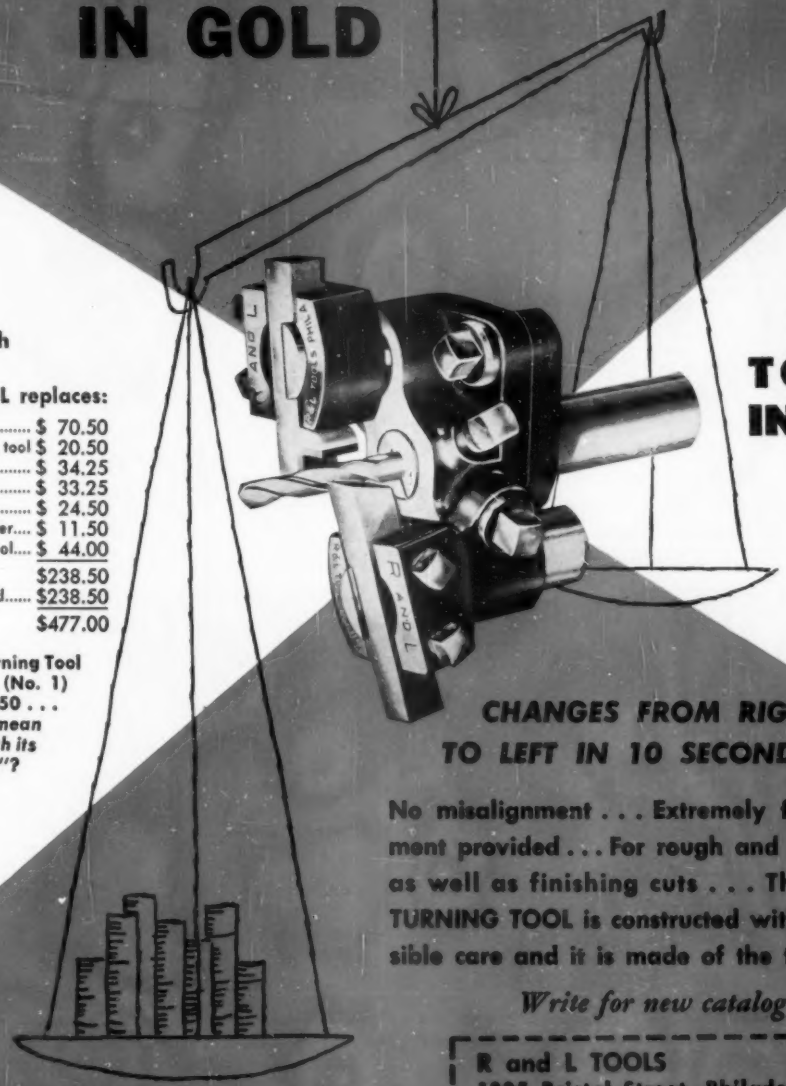


Socket pressure plugs. Standard sizes ⅛ to 1¼ in.

Socket set screws. All standard point types. #6 to 1 in.

WORTH ITS WEIGHT IN GOLD

R and L TURNING TOOL



14 TOOLS IN ONE

Here are the tools which the R and L TURNING TOOL replaces:

Roller Box Tool	$ 70.50
Centering & facing tool	$ 20.50
Knee Tool	$ 34.25
Pointing Tool	$ 33.25
Back Rest	$ 24.50
Floating Drill Holder	$ 11.50
Balance Turning Tool	$ 44.00
	$238.50
Same for left hand	$238.50
	$477.00

One R and L Turning Tool of similar size (No. 1) costs only $87.50 . . . ***See what we mean by being "Worth its weight in gold"?***

CHANGES FROM RIGHT TO LEFT IN 10 SECONDS

No misalignment . . . Extremely fine adjustment provided . . . For rough and heavy cuts as well as finishing cuts . . . The R and L TURNING TOOL is constructed with best possible care and it is made of the finest steel!

Write for new catalog

R and L TOOLS
1825 Bristol Street, Philadelphia 40, Pa.

☐ Send new catalog
☐ Please arrange for no-obligation demonstration of R and L TOOLS

NAME .....

COMPANY .....

ADDRESS .....

.....

TS-12

RIGHT R and L LEFT TOOLS

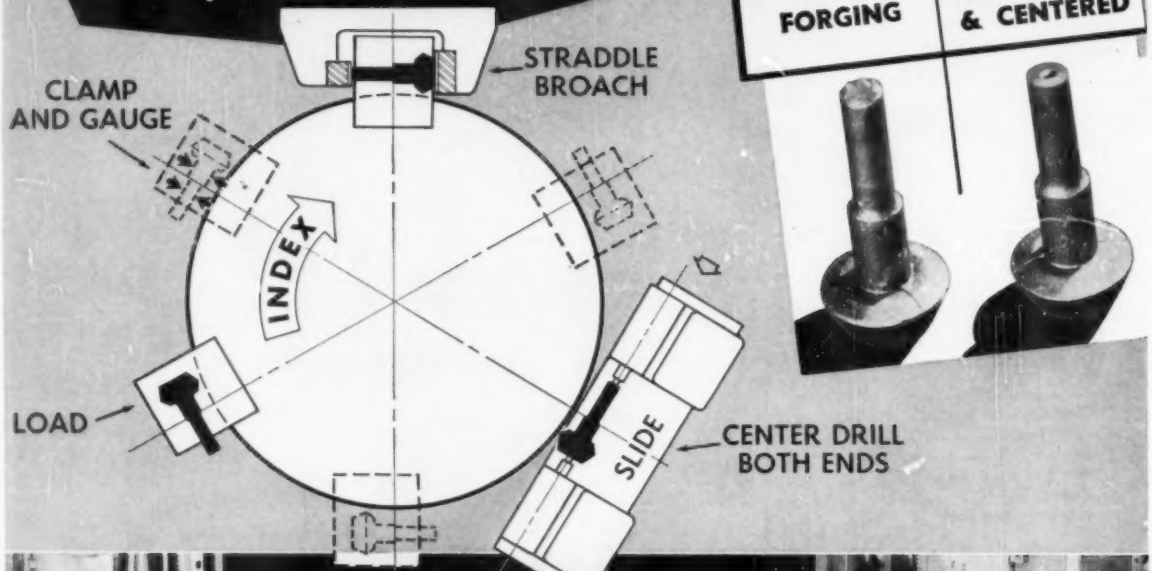
1825 BRISTOL STREET • PHILADELPHIA 40, PA.

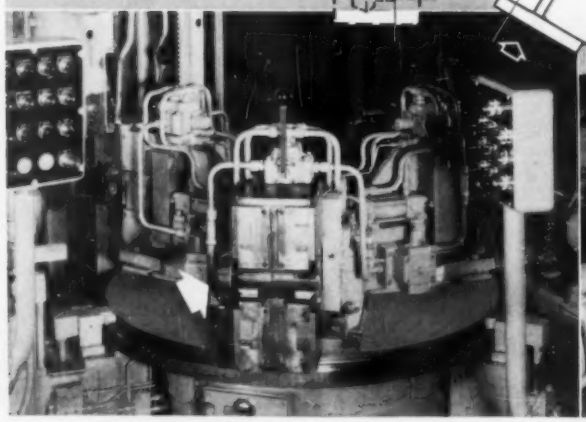
TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-RELEASING TAP AND DIE HOLDERS • RELEASING DIE HOLDER FOR ACORN DIES • UNIVERSAL TOOL POST • CUT-OFF BLADE HOLDER • RECESSING TOOL • REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL

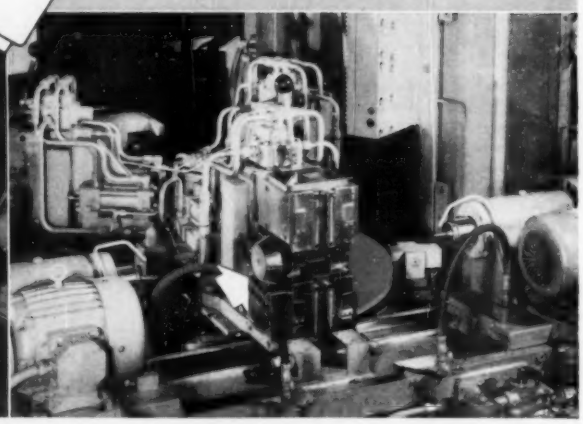
ANOTHER *American* FIRST

DIAL-INDEX, BROACH AND CENTER MACHINE FINISHES 2 ENDS OF PINION

. . . 170 parts per hour







Automative pinion forgings are loaded at this, the first of six stations on a dial-type indexing unit. At the next station, part is automatically clamped and gauged — oversize parts stop the cycle. At the third station, both ends of pinion are straddle broached.

While one part is being broached, both ends of another part are being center drilled at the station shown here. Broaching, drilling and dial indexing are interlocked and completely automatic. Operator has time to unload and reload fixtures as they index to him.

Write or 'phone details of your broaching requirements. Or write for Catalog 450.

AMERICAN

American BROACH & MACHINE CO.

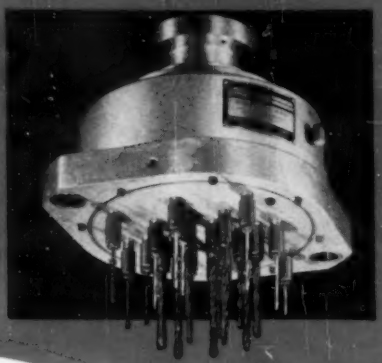
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

SUNDSTRAND

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

MAKE ZAGAR your HOLE CENTER FOR DRILLING, REAMING AND TAPPING . . . . . .

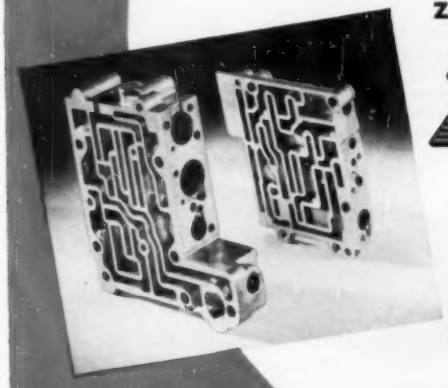


Any hole pattern — on any center up to 1½" dia.

Zagar's Broad-Scope Engineering SOLVES ANY HOLE PROBLEM

Zagar meets every drilling problem with the most effective, low cost equipment: gearless drill heads, standard drilling machines, special drilling machines, and index, trunnion or pallet-type multi-station transfer machines. We can furnish the complete tooling if you desire. Perhaps Zagar drill heads can be installed profitably on your own drill press. Send us a drawing of the part you are planning to drill. Or, let us study your present situation with a view to reducing your drilling cost.

ZAGAR, INC., 23892 Lakeland Blvd., Cleveland 23, Ohio

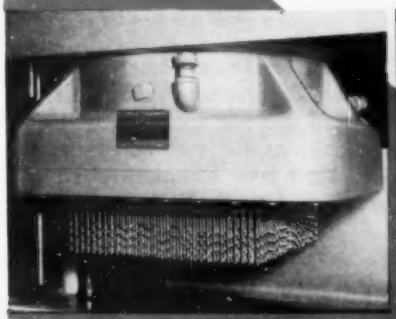


Any machinable material — from all angles.

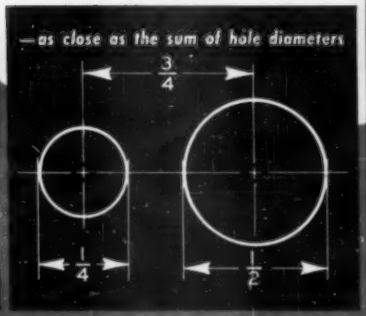
Zagar

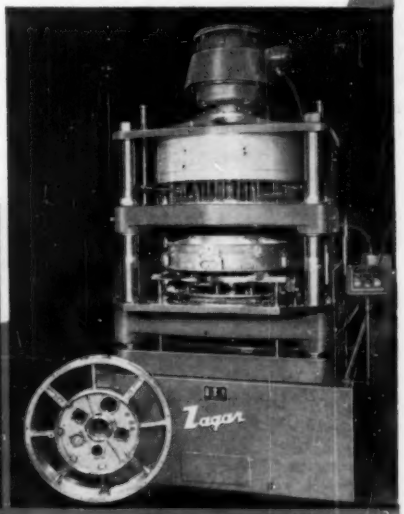
Write for our 9-page General Bulletin "E-12"

TOOLS FOR INDUSTRY and SPECIAL MACHINERY

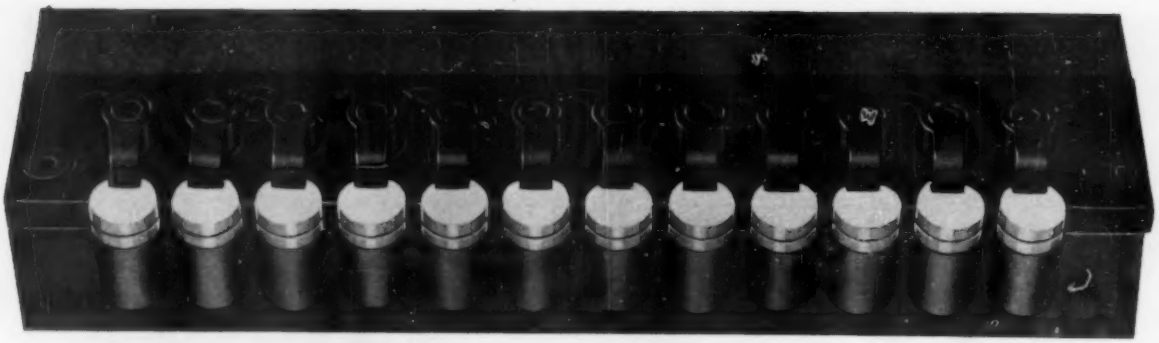


Up to 1000 holes can be drilled IN ONE PASS.





4-post ram-type drilling machine for aircraft parts.



Kendex* multiple grooving tool, with 12 Kennametal "turnover" button inserts, and shims of Kennametal for fast groove cutting and rapid, accurate indexing

KENNAMETAL* Tooling for Special Jobs

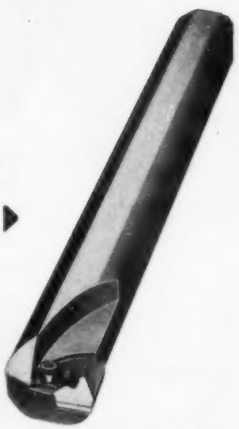
Kendex principle is adaptable to a wide variety of job requirements

Many machining jobs often can be done better, faster, or at less cost with a new cutting tool . . . or a tool that is adapted to the existing conditions. The photographs illustrate this point, showing Kendex* Tooling re-designed for specific jobs.

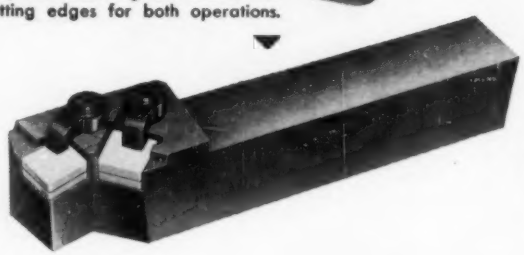
Experienced Kennametal engineers will work with you to find the best approach to your metal-cutting problems. Often a modified standard tool is the answer, and your Kennametal tool engineer will recommend it. Sometimes an entirely new approach with specialized tooling may be the only solution to improve production. In either case, the chances are that Kennametal's experience during the last 18 years has solved a similar problem. Result: Time is saved . . . development work is reduced to a minimum . . . the basic design has been proven.

If you have a stubborn, high-cost production job, perhaps your Kennametal tool engineer can quickly suggest a solution. He devotes his time exclusively to tooling problems with one objective —to get the right tool and right grade of Kennametal on the job. His broad experience in tool design and tool application is supplemented by that of our Research and Engineering staffs. All are constantly at work to provide the best tools and most practical techniques for metal-cutting and forming operations. Call your Kennametal Representative or write to KENNAMETAL INC., Latrobe, Pa.

Boring bar utilizing Kendex clamped-holder principle and Kennametal triangular inserts of the "turn-over" throw-away type . . . eliminates grinding . . . reduces downtime.



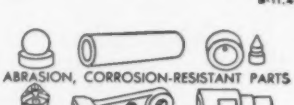
Facing and chamfering completed in one pass with a two-in-one Kendex Tool and Kennametal inserts. Another advantage: Since only the middle of chamfering insert is used, the two inserts may be interchanged after use, thus doubling the number of cutting edges for both operations.



*Trademarks

B-11.404

INDUSTRY AND KENNAMETAL ...Partners in Progress



Gardner-Denver . . . Serving the World's Basic Industries

6-spindle Multiple Nut Setter assembles auto flywheel to crankshaft.

A New Keller Tool Fastening Technique Sets New Highs in Assembly Efficiency

Results: reduced costs — control of quality

If you have to set two or more nuts or bolts at a time, you've got a job for Keller Tool Multiple Spindle Nut Setters.

In one simple unit, from 2 to 20 spindles do the work in a fraction of the time required with a single spindle tool.

Designed for extreme flexibility: Standard air motors of any size can be combined in the same tool. Tight bolt clusters . . . different torque requirements . . . bolts at different elevations are adaptations. Handles and suspension can be positioned where desired. Let Keller suggest a setup for you.

Features you can use—profitably!

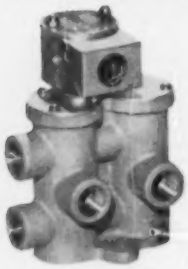
1. Adjustable torque control on individual spindles. Fourteen sizes cover torque range from 4 to 190 ft.-lb.
2. Torque held to close tolerances—equal to that of accurate hand tools.
3. Easily adapted to changing needs—a new mounting plate does the trick.

GARDNER - DENVER

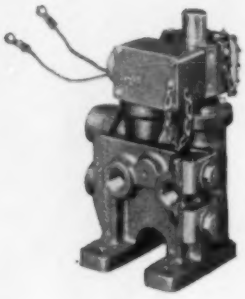
KELLER TOOL division, Grand Haven, Michigan

THE QUALITY LEADER IN COMPRESSORS, PUMPS, ROCK DRILLS AND AIR TOOLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

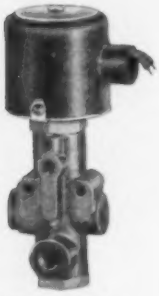
YOUR COIL BURNOUT TROUBLES ARE OVER when you switch to Crescent® Solenoid Valves



Standard 4-Way



J.I.C. Type 4-Way



Standard 3-Way

® 4-Way and 3-Way Solenoid operated, pilot controlled valves for Air, Water and light oil to 150 P.S.I., products of Crescent Valve Co.

NO COIL BURNOUT

because a generous power margin, short solenoid travel and pilot operation combine to prevent overheating and overloading. Note that these valves are accepted and used in automotive plants where assembly line production does not permit coil or valve failure.

LONG SERVICE LIFE

Main valve design is aimed at extremely long trouble free service. Resilient seats are tight sealing and are not affected or damaged by dirt or grit because they are of a self scavenging design. Witness their superior performance in such severe service as operating hopper doors on cement batching equipment and in other dusty environment.

INTERCHANGEABILITY

Solenoids and pilot sections are interchangeable from one valve size to another, minimizing spare parts requirements. Adaptation to any practical voltage is achieved by a simple coil change.

Speed of response, speed of installation and dependable leakproof operation year in and year out are responsible for the increasing switch to Crescent valves on production machinery where time is money.

For complete data write for Catalog 6-C.

BARKSDALE VALVES

5125 Alcoa Avenue, Los Angeles 58, California

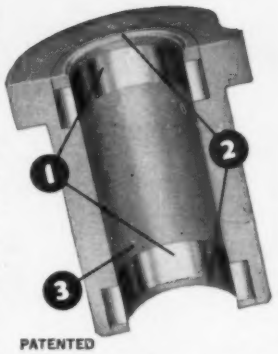
USE READER SERVICE CARD; INDICATE A-12-254-1

MEYCO CARBIDE INSERTED DRILL JIG BUSHINGS PROVE THEMSELVES *IN Automation!*

The reason is simple: these unique bushings are ideally suited for long-running, uninterrupted operations!

MEYCO carbide inserted bushings assure long life for drills, jigs, fixtures . . . accurate work maintained, resulting in less down-time, fewer lost man-hours. Last almost as long as solid carbide bushings, cost slightly more than ordinary bushings. Get the full story:

Write for information and price list, ask for Catalog No. 42



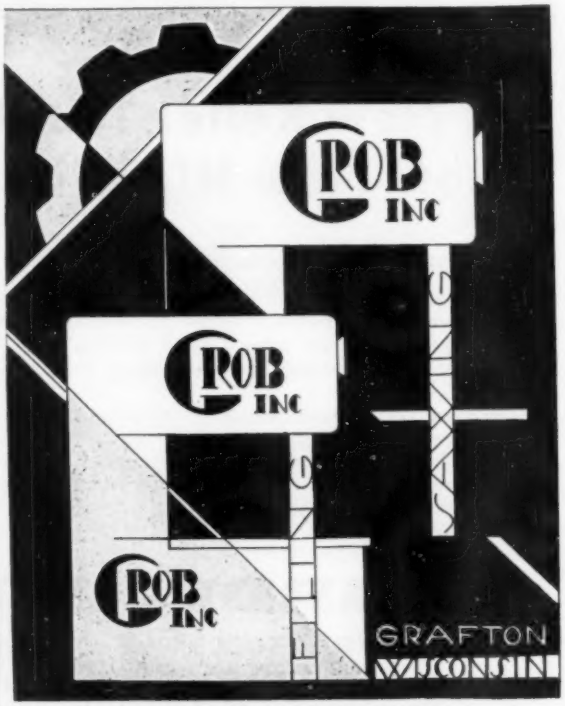
PATENTED

1. Tungsten carbide rings at the points of wear; 2. Steel rings protect drills and carbide; 3. Special hardened alloy steel body.

EST. 1888

W. F. MEYERS CO., INC., BEDFORD, INDIANA

USE READER SERVICE CARD; INDICATE A-12-254-2



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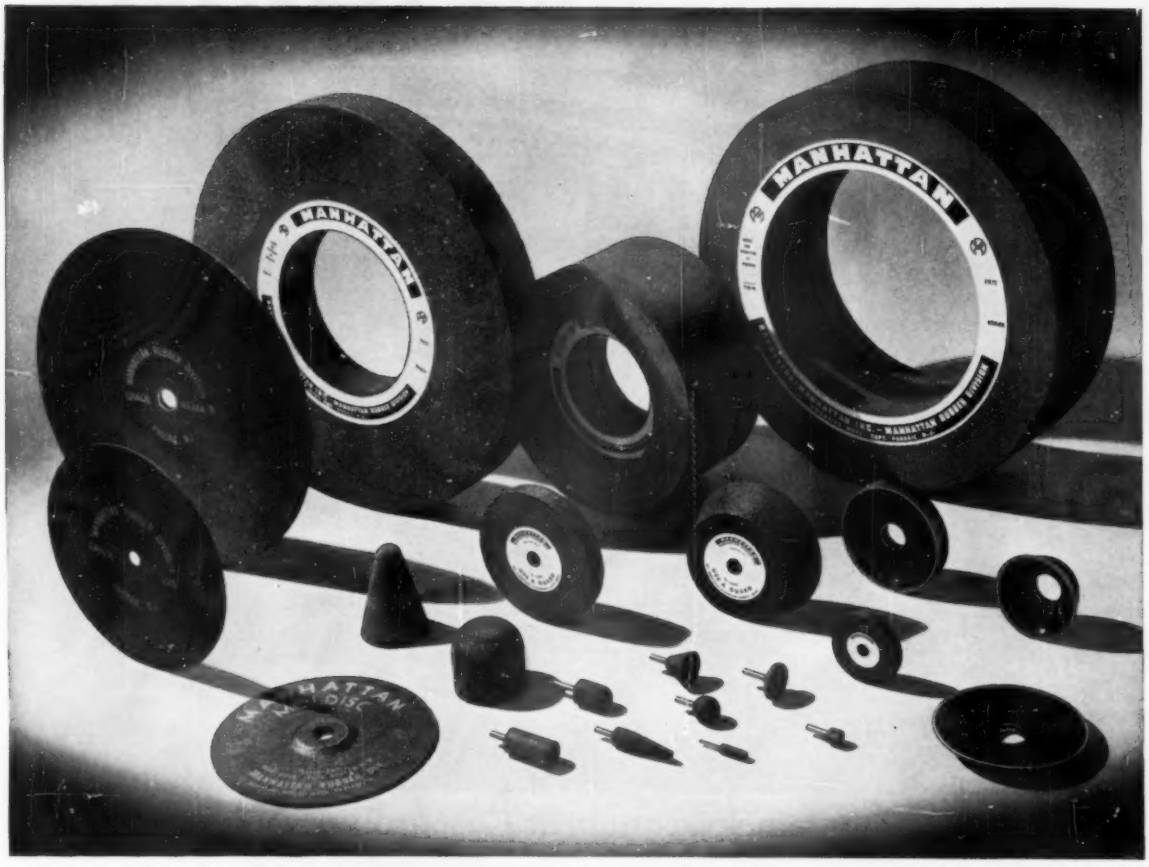


Use MANHATTAN ABRASIVE WHEELS for Faster Cutting and Grinding . . .

Whatever your needs, a Manhattan Abrasive Wheel can be engineered for your particular alloy requirements. Manhattan Abrasive Wheel Specialists help solve problems at *your* plant, for faster cutting, rough grinding or finishing. Every component of the wheel they specify—abrasive, grain size, hardness, structure and bond—is custom-designed for your working conditions to remove *more* metal, *faster* . . . at *lower* cost.

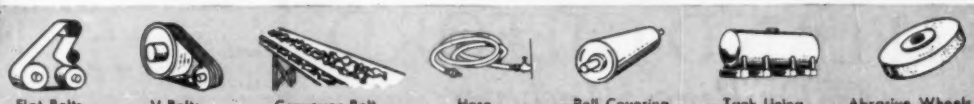
ROUGHING WHEELS • FINISHING WHEELS
CUT-OFF WHEELS • MOLDISCS • DIAMOND WHEELS for

Foundry Snagging—Billet Surfacing
Centerless Grinding
General purpose grinding with portables
Grinding and Finishing stainless steel welds
Bearing Race Grinding and Finishing
Finishing Tools and Cutlery
Cutting-off—Wet or Dry—Bars, Tubing, Structurals, etc.
Foundry Cutting—standard and reinforced wheels
Grinding Carbide Tipped Tools

Discuss your metal removal requirements with a Manhattan Abrasive Wheel Specialist. He'll show you how you can get more output per man hour . . . "More Use per Dollar".

WRITE TO ABRASIVE WHEEL DEPARTMENT
MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.



Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings
Asbestos Textiles • Packings • Engineered Plastic, and Sintered Metal Products • Laundry Pads and Covers • Bowling Balls

COMPLEX DRILLING PROBLEMS?

Here's how Belock Instrument Corp. solves theirs with modern punched card production control and . . .

LELAND-GIFFORD *Multiple Spindle* DRILLING MACHINES

Belock Instrument Corp. of College Point, N. Y., builds fire control systems, bomb sights, radio frequency tracking equipment and other precision electronic and mechanical equipment. Some of these units have as many as 7000 precision parts.

To keep on top of their complex production drilling operations, Belock employs an IBM punched card system to budget machine time and to schedule related operations for maximum machine utilization.

At the business end of this modern production control system is this battery of Leland-Gifford Multiple Spindle Drilling Machines. Each job goes to the right machine where the right tools are ready for use, in the combination called for, with the right speed instantly set and checked by the Leland-Gifford indicating shift. Centralized controls and built-in safeguards against costly errors also help to speed work flow.

Always preferred for precision drilling, today's Leland-Gifford machines offer you even more in performance, economy and efficiency. New bulletins describe the latest time-saving, cost cutting features. Write for them.

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LOS ANGELES OFFICE
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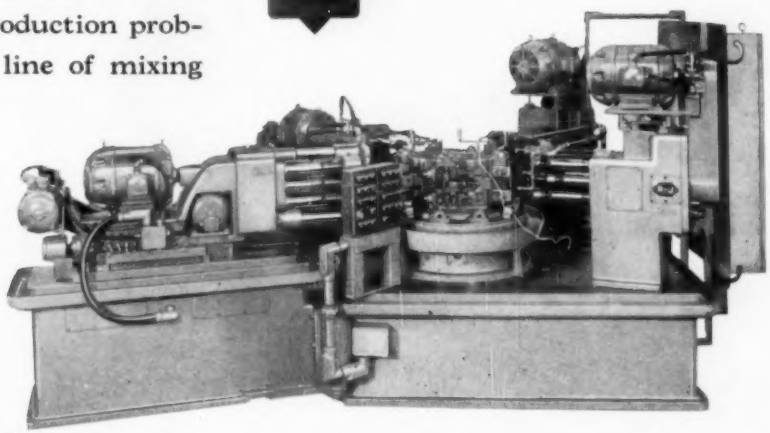
INDIANAPOLIS 6, P. O. Box 1051
ROCHESTER 12, P. O. Box 24, Charlotte Station

You cannot afford to have obsolete production equipment with which you just "get by." Investigate R-J production equipment—designed for a particular job—to give the maximum in production—to help you make more profits.

REHNBERG-JACOBSON

The machine illustrated was designed and built by R-J for one of America's largest plumbing manufacturers. They came to R-J for a solution to machining and production problems on their line of mixing faucets.



MACHINES THAT PRODUCE!

Be sure to include R-J when you are considering possible sources of production machines. Our prices and deliveries will interest you. Send your inquiries today to R-J for prompt quotations.

REHNBERG-JACOBSON MANUFACTURING CO., 2135 KISHWAUKEE ST., ROCKFORD, ILLINOIS

DESIGNERS, ENGINEERS, MANUFACTURERS AND PRODUCTION CONSULTANTS

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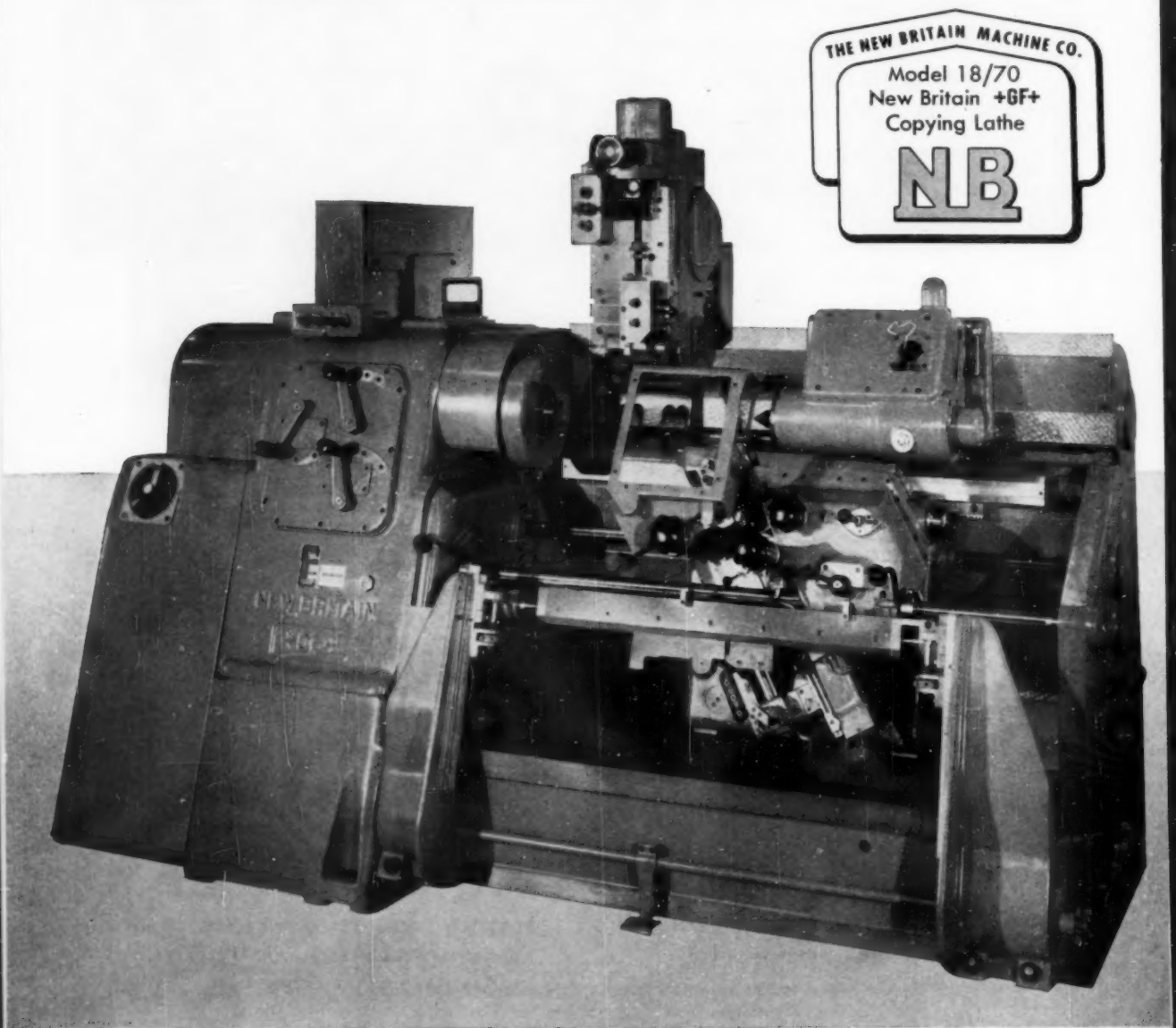
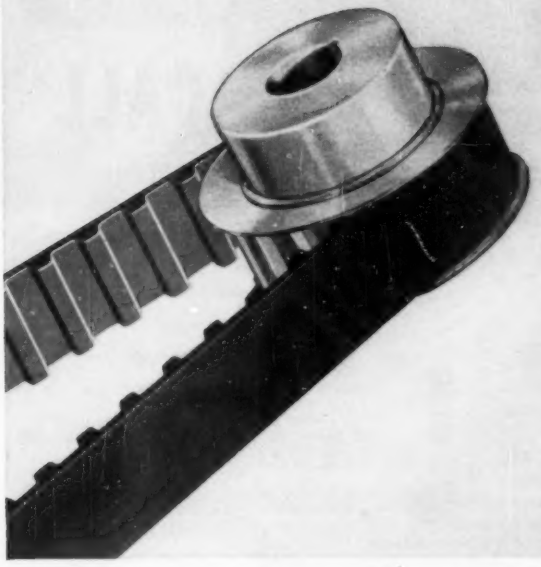
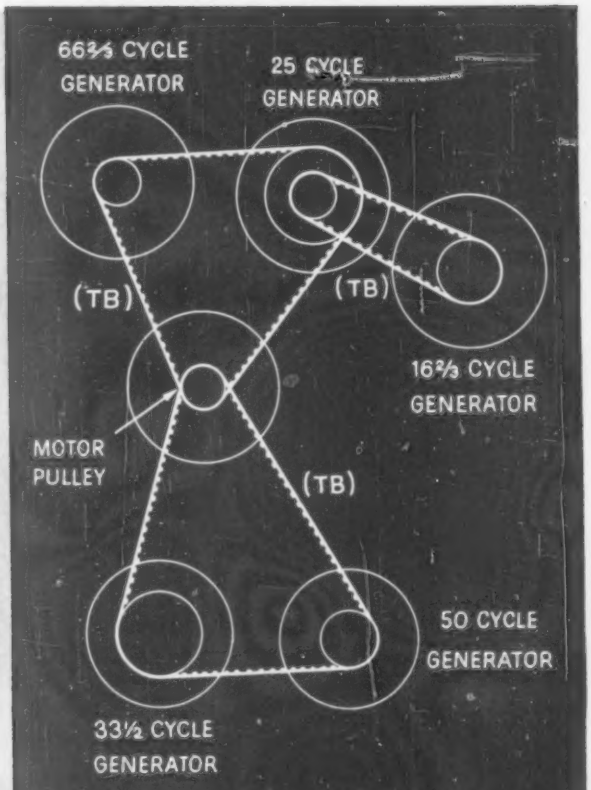
On this New Britain +GF+ Copying Lathe, you can make an accurate first piece from a blueprint—then *copy* it accurately a million times if your requirements call for it. New Britain can supply automatic loading too, if it makes sense on your work. Let us give you the complete story of this new contour approach to turning in a color motion picture demonstration in your office. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



US RUBBER **PowerGrip** "TIMING" BELTS

Making one motor do the job of five





Above is a schematic drawing of a 5-frequency telephone ringing unit on a party-line system. Previously, five motors were needed to generate the different ringing frequencies. But with the installation of just *three* U.S. PowerGrip "Timing" Belts (TB) *only one motor is needed* now. That's because U.S. PowerGrip provides a positive, non-slip grip that preserves the exact speed ratios and the synchronization needed to maintain critical frequencies. And there is absolutely no measurable power loss.

This is one more example of the U.S. PowerGrip "Timing"® Belt's ability to simplify and improve a power transmission unit . . . one of the reasons why the invention of U.S. PowerGrip "Timing" Belt was recently awarded the Franklin Institute's Edward Longstreth Medal for "Invention of High Order."

Whether it's for the design of hand tools, lathes, drill presses, saws, electric typewriters—from fleapower to horsepower—U.S. PowerGrip offers all these advantages:

- *no slippage, no take-up—allows short centers, high ratios.*
- *absence of metal-to-metal contact—eliminates need for lubrication and housing devices.*
- *handles speeds up to 16,000 F.P.M. or so slow as to be imperceptible to the eye.*
- *close to 100% efficiency.*
- *imbedded with steel cables for high tensile strength*
- *constant angular velocity.*

These belts—plus expert engineering service—are obtainable at "U.S." power transmission distributors, at any of the 28 "U.S." District Offices, or by writing us at Rockefeller Center, New York 20, N. Y.

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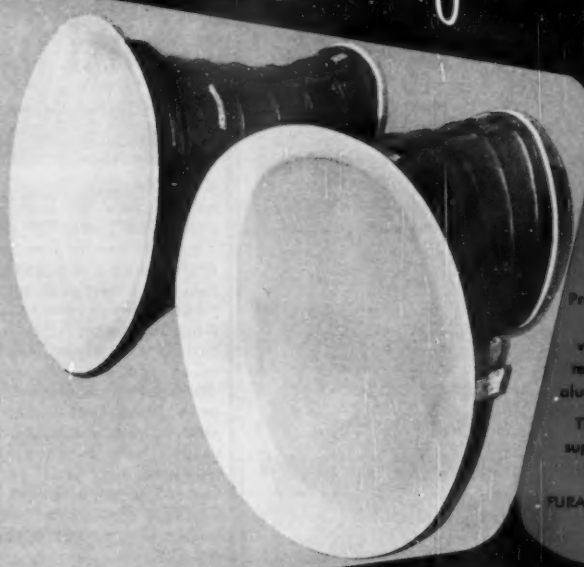
A Test of Strength

EPOCAST



Accurate Plastic Tooling & Pattern Company, Inc., of Columbus, Ohio, utilizes EPOCAST 7-A surface coat resin and EPOCAST 2 luminating resin, to make these large bell mounts for testing aircraft jet engines at General Electric and Allison, a division of General Motors. Previously, the bell mounts were made of aluminum, but the vibration of the engine during testing procedures fatigued the aluminum after a very short time.

This is another example of the superiority of plastics over metal for a particular requirement.

FURANE invites your inquiries where you have a plastic tooling problem.

furane plastics
INCORPORATED
4516 Brazil Street, Los Angeles 39, California

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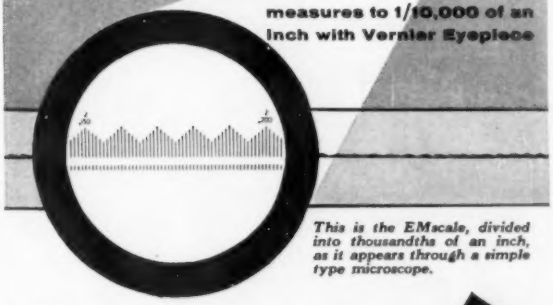
The NEW Direct Reading EMscale

measures to 1/10,000 of an Inch with Vernier Eyepiece



This is the EMscale, divided into thousandths of an inch, as it appears through a simple type microscope.

Now for the first time you can measure to thousandths and ten thousandths of an inch, clearly, sharply, accurately with a direct reading scale. Introduces a new concept in micro-measuring with almost unlimited application.

Learn all the facts. Send for this EMscale brochure today.

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NEW INFORMATIVE DATA on STRIPPABLE PROTECTIVE COATINGS

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"Not one failure in 30 years," says Project Engineer, Walt Holms of Dexter Folder Company as . . .

Bristol's® Multiple-Spline socket screw solves 3 design problems here

On Dexter Folder Company's Cleveland folding machines, they didn't start out using Bristol's® Multiple-Spline socket screws.

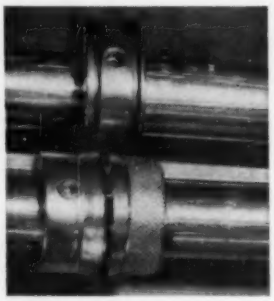
The switch to multiple-spline socket screws was made later on to overcome three difficulties caused by ordinary set screws:

1. Rounding out of sockets was common until the changeover to the multiple-spline screw. *"These Bristol screws are set and loosened as many as 1000 times during the machine's life, yet I never heard of a Bristol multiple-spline socket rounding out,"* reports Mr. Holms.

2. "Burrs" on the shafts, caused by the original steel set screws, were blocking movement of attachments along the shaft. To overcome this difficulty, Bristol engineers developed a new set screw design featuring a relatively soft brass point which could not harm the steel shaft.

3. Permanently mounted equipment, gears, pulleys and the like, used to freeze on the shaft after being in place for 5 or 10 years. The old set screws would frequently strip before loosening. Not one socket failure in 30 years has been noted since Dexter switched to Bristol's multiple-spline socket.

With 20,000 existing folding machines in operation and over 100 Bristol multiple-spline set screws in each, Dexter Folder Company's report on their performance carries considerable weight. Bristol's socket screw products—the most complete line on the market—are sold through leading industrial distributors. Find out about them today.



Bristol set screws hold perforator and grooved-wheel in tight alignment. Slippage here would damage knife blades. A.6.19

Precision socket screw manufacturers since 1913

*Made in sizes as small as No. 0 in Alloy Steel and Stainless Steel. Cap Screws up to 1½".

THE BRISTOL COMPANY, Socket Screw Division, Waterbury 20, Conn

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THE KING PORTABLE BRINELL HARDNESS TESTER

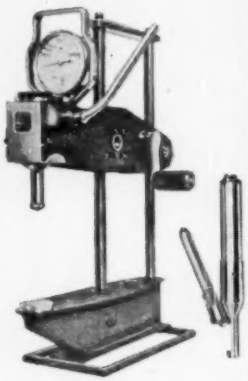
Known the World over for Accuracy & Dependability

Takes Brinell Tests in Hard to Reach Spots

King Portable Brinell Hardness Testers are rugged, accurate and easy to operate. They give trouble free versatile performance, and guaranteed accurate readings in spots that no other tester can reach.

King Hardness Testers can be carried anywhere, and can make tests in any position. They put a full load of 3000kg on a 10mm ball—other loads as required. 5mm and 10mm carbide balls used for castings and hard materials.

Gap 13½" high, throat 4" or 6", Test Head removable for testing larger parts. Weight only 28 lbs.



For complete specifications on standard testing machines or adaptations made to your special requirements, write

KING TESTER CORPORATION

Dept. T, 440 North 13th St., Philadelphia 23, Pa.

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Speed Versatility and Economy

Tooling costs go down when Speed Vise goes on the job because Speed Vise eliminates the need for expensive jigs and fixtures. Just a simple jaw plate to fit the part being drilled and Speed Vise does the rest. Several interchangeable Speed Vise jigs and fixtures can be made for the cost of one old style box type jig. The operation of Speed Vise tooling is many times faster than the operation of such conventional jigs and fixtures. Speed Vise tooling is economical to build, efficient to use, compact to store.

-SPEED VISE-

GIVES YOU 100 JIGS IN ONE

$10.90 to $22.90

- ★ Quick action design for speed. Opens instantly to full capacity to handle work of any size.
- ★ Standardized holes for attaching jigs or jaw plates.
- ★ Lift...slide...lock...that's all there is to the fast, positive locking action.
- ★ Heavy, semi-steel castings for extra strength and a heavy base plate for rigidity.

Write or wire now for information

CARDINAL MACHINE CO.

1819 Dana Street
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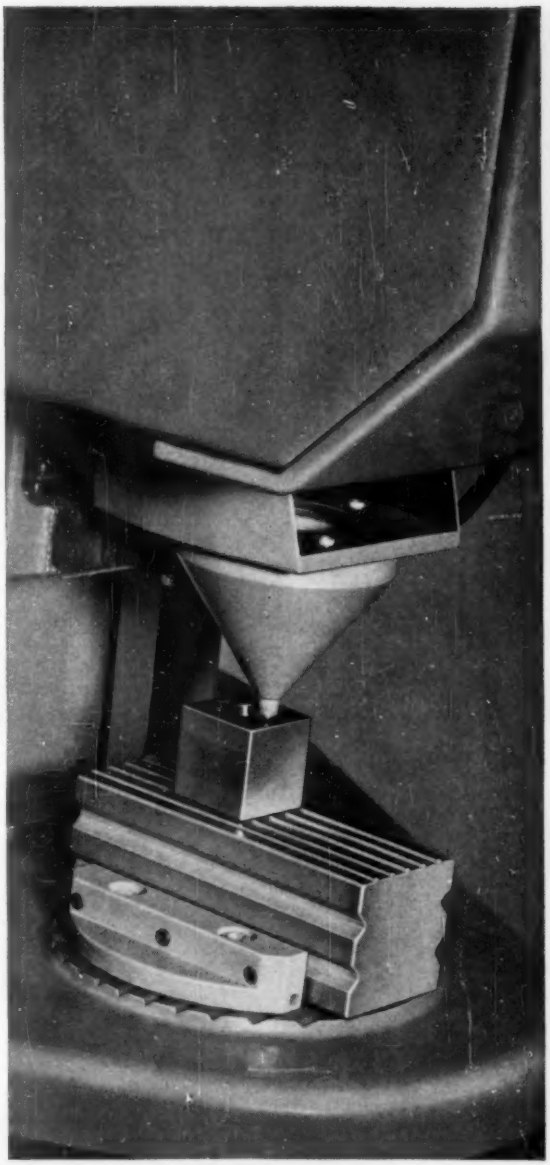
THE *FRINGECOUNT** MICROMETER



DIRECT MEASUREMENT TO
0.000001"
SIMPLE TO OPERATE...DIGITAL READING

The new FRINGECOUNT micrometer brings laboratory precision with increased speed to your inspection and quality control departments.

This new precision instrument is particularly suited to the measurement of gage blocks, plug gages, other external standards as well as close tolerance production parts.

The most stable measuring standard known – the wavelength of light – is the gage put to use in the FRINGECOUNT micrometer. It combines the interferometric principle with an electronic system which counts light fringes – projects them into a digital counter for fast interpretation into a dimension.

Operation is simple – just *two* push-button controls. Other FRINGECOUNT advantages:

- Eliminates need for expensive master blocks.
- Measures flat or round parts equally well, equally fast.
- Adapts to many special measuring situations through the use of different anvils and spindles.
- Requires no calibration. As stable as the light source.

Find out how the FRINGECOUNT can be used in your operation; Write us today, Department TE for Bulletin LP-3521.

*Trade Mark of Link Aviation.

1 **INTERFEROMETER** . . . high stability of the mechanical and optical system assures extreme accuracy — up to 0.000001" — throughout the FRINGECOUNT'S 0 to 2" range.

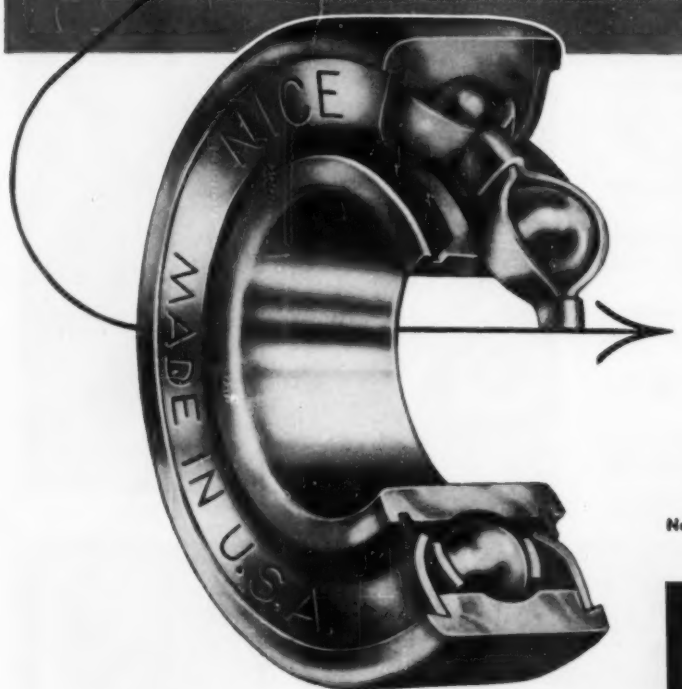
2 **COUNTER** . . . EASY TO READ COUNTER gives instantaneous digital presentation of light fringes which are directly interpretable into a dimension.

3 **CONTROL UNIT** . . . push button controls provide bi-directional operation of the motor driven head and zero setting of the instrument.

LINK AVIATION, INC.
A SUBSIDIARY OF GENERAL PRECISION EQUIPMENT CORPORATION
BINGHAMTON, NEW YORK

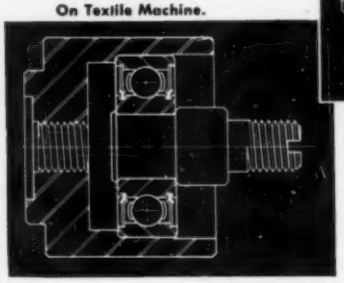
GPE

NICE IS THE WORD FOR BEARINGS

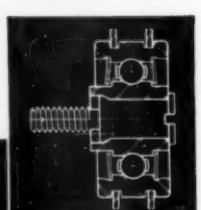


"1600" Series Precision and "3000" Series Unground "Precision Type", Composition Sealed.

The NICE line of ball bearings includes over 750 sizes and types of standard bearings and more than 2500 "specials". This provides a wide range of precision, semi-precision, and unground bearings available to the product designer. If a new "special" is the functional or economic answer to the problem, NICE engineers can design a bearing that will be exactly right for the particular application.



No. 7061 Spindleless Attachment For Spool Winding On Textile Machine.



No. 7069 Tape Guide Roller For Business Machine.

Write for Catalog No. 150

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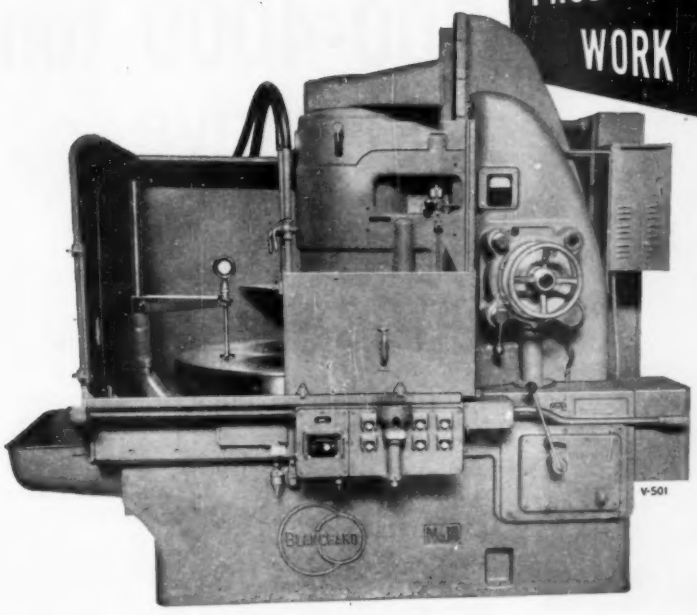
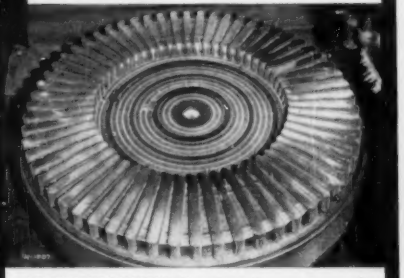
NICETOWN · PHILADELPHIA · PENNSYLVANIA

for BEST results in surface grinding...
PUT IT ON THE BLANCHARD

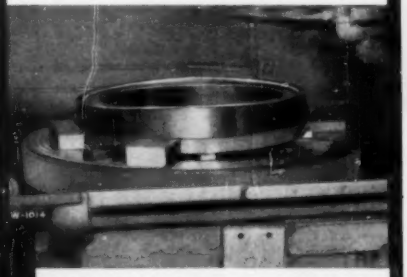


PRODUCTION WORK

SIDE PLATES. 9" x 18" plates ground from rough on No. 18 Blanchard with 36" chuck. Stock removal 1/16" to 1/8" per side. Held flat within .003", parallel to .001", and to dimension tolerance of ±.001". Production: 30 surfaces per hour.

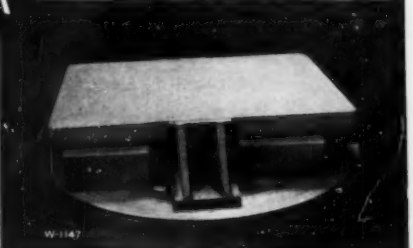


CONNECTING LEVERS. Cast iron levers ground in special magnetic fixture with pins located in "vee's". Stock removal per side is 1/32" to 1/16"; must be flat and at right angles to pins. No. 18 production: 180 pieces per hour, compared to 20 pieces per hour by former method used.



MAINTENANCE AND ODD LOT WORK

HARDENED STEEL PUNCHES. This 24-13/16" dia. punch, reground on a No. 18, is centered radially on 36" magnetic chuck. Duplicate circumferential and radial shear reliefs are generated with two setups.



GRANITE SURFACE PLATES. A No. 18 Blanchard reconditions this 18" x 34" granite surface plate by grinding it flat within .0002". 3/16" of stock is removed in 5 hours.

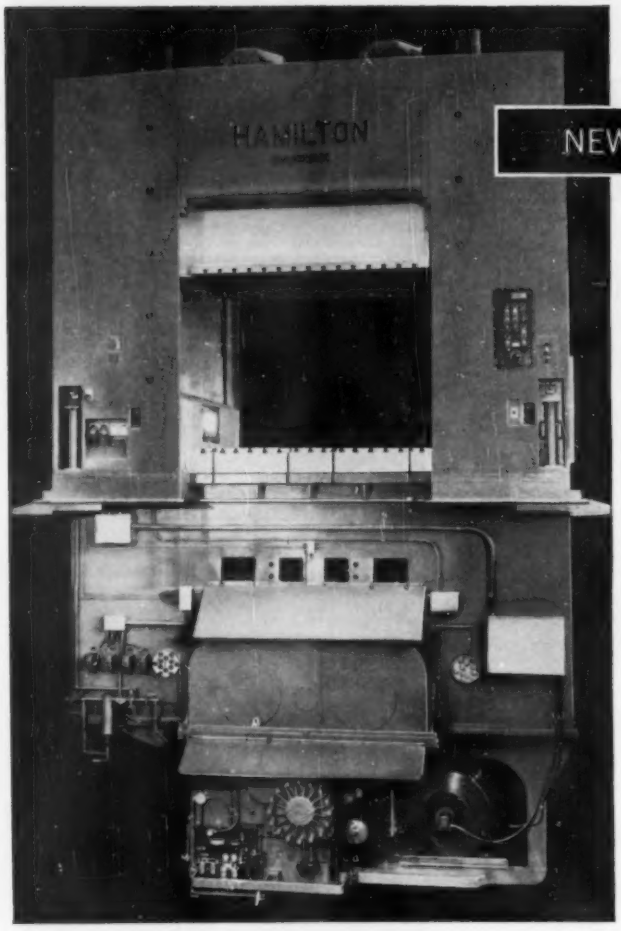
Blanchard Grinders are used throughout industry on surface grinding jobs that demand the utmost in production, finish and accuracy.

Whatever *you're* surface grinding, there's a Blanchard designed to do the job speedily and accurately.

PUT IT ON THE **BLANCHARD**

Send for free copies of "Work done on the Blanchard", fifth edition, and "The Art of Blanchard Surface Grinding".

THE BLANCHARD MACHINE COMPANY
64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.



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New 500-4000 ton underdrive draw press "package"...

for fast easy installation...
simplified maintenance...
smooth, safe drawing...
more productive strokes per minute

Thirty years the leader in the mechanical press field, Hamilton now gives you this latest product of dynamic press know-how. An all-new line of 500 to 4000 ton mechanical draw presses engineered for fast, safe drawing operation . . . with each press a "package unit" for quick installation, easy maintenance.

- *Package design* keeps all piping and wiring within the rugged, welded steel press structure. Installation is quick and easy.
- *Hamilton's Exclusive Double-Lube system* provides both pressure and gravity flow lubrication to all bearings.
- *Operating mechanism in the press bed* simplifies inspection and maintenance during operations.
- *Variable cycle sequences* insure more productive strokes per minute.
- *Swivel arrangement of counterbalance cylinders* insures proper alignment when gibs are adjusted.

You'll speed your production while you slash installation and operating costs . . . with these new Hamilton underdrive presses in your shop. They're designed and built to handle your toughest jobs better, faster—with far less downtime. Get the full story today! Write for complete specifications to Dept. 9677, Hamilton Division, BLH Corp., Hamilton, Ohio.

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HIGH PRODUCTION AIR PRESS

with more Quality Features

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★ Brass cylinder, aluminum end castings, Hy-Car piston cups.
★ Accurately ground table.
★ Fast set-up and stroke adjustment.

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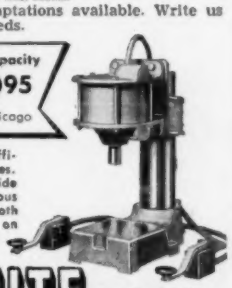

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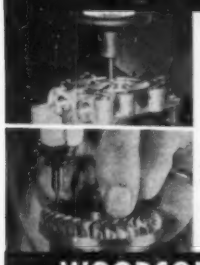

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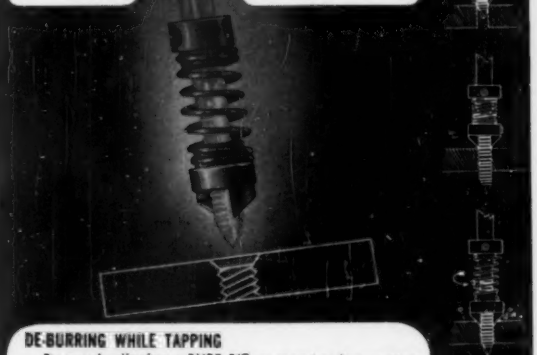

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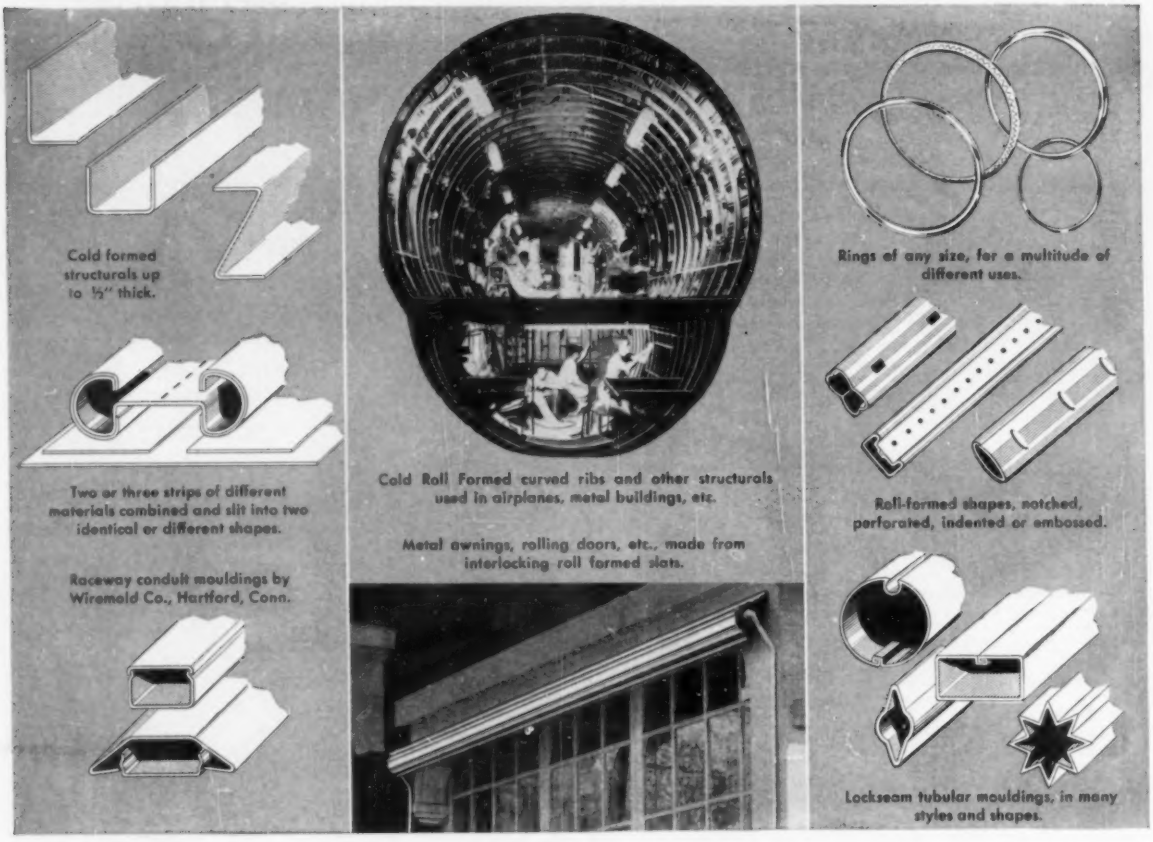
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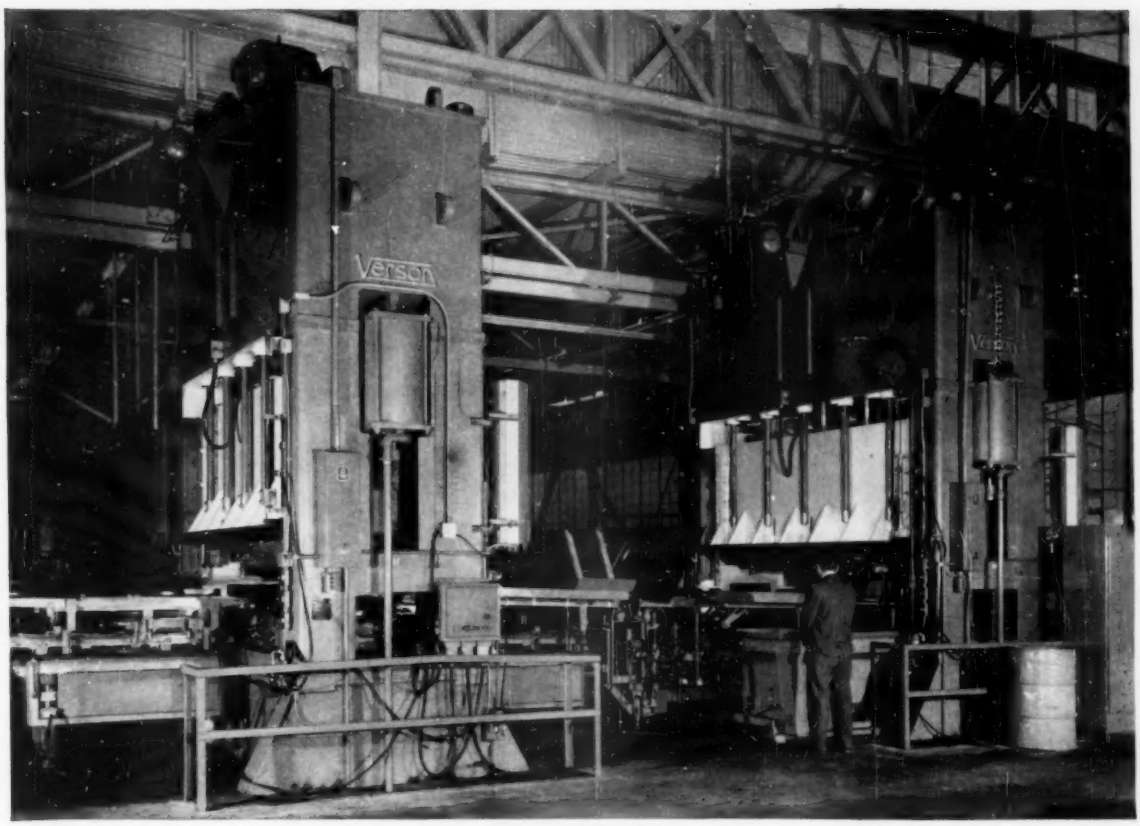

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The Tool Engineer

1956 Annual Index of Technical Articles

Volume XXXVI and XXXVII

This annual index for the past twelve issues lists subjects treated in Technical Section as well as the Foreign Abstracts and Technical Digests departments. It is divided into two parts. The first is an alphabetical author's index listing article titles. The second part is a subject listing cross indexed for easy reference. Short items less than a page are indicated by an asterisk. Important subtopics are indexed along with major subjects. In this manner all references to a desired subject can be located.

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This alphabetical index of advertisers includes all advertisers who have appeared in THE TOOL ENGINEER during 1956, and the issues which carried their advertisements. The January 1957 issue will list these advertisers according to classification of advertisements by subject matter.

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*Hardinge Brotehrs, Inc.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
Hart Milling Fixtures—Jan., Mar., May, Sept., Nov.
♦Hartford Special Machinery Co., The—Feb., Mar., Apr., May, June, July, Sept., Oct., Nov.
*Haskins, R. G., Co.—Mar.
*Haynes Stellite Co., A Division of Union Carbide & Carbon Corp.—Feb., Mar., May, July, Oct., Dec.
Heald Machine Co., Subsidiary,
Cincinnati Milling Machine Co.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
*Heinrich Tools, Inc.—Mar.
Heller Machine Co.—Jan., Feb., Mar., Apr., May, June, July
*Heller Tool Co., Subsidiary
Simonds Saw & Steel Co.—Mar., May, Sept., Nov.
Hendey Machine Division,
Barber-Colman Co.—Mar., May, July, Oct.
*Henry & Wright Press Div.,
The Emhart Mfg. Co.—Mar., June, Sept., Dec.
High Standard Mfg. Corp., The—June, Sept.
Hill Acme Co., The—Mar., June, Oct.
Hill Machine Co.—Feb., Mar.
Hoggson & Pettis Mfg. Co.—Feb., Apr., June, Aug., Oct., Dec.
Homestrand, Inc.—Mar., May
♦*Horton Chuck Division,
Greenfield Tap & Die Corp.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
*Howe & Fant, Inc.—Jan., Mar.
*Huron Machine Products—Nov.
Hydro-Form Division,
Cincinnati Milling Machine Co.—Mar., July, Sept., Nov.
Hydrospin Division,
Cincinnati Milling Machine Co.—Jan., May, Nov.
Hydraulic Power Division,
Hydraulic Press Mfg. Co.—Feb., Apr., June, Aug., Oct., Dec.
Hyprez Division,
Engis Equipment Co.—Feb., Apr.
Hypro Tool Co.—Jan., Feb., Mar., May, Sept., Oct.

I

*Ideal Industries, Inc.—Mar., May, June, July, Aug., Sept., Oct.
*Illinois Metal Products—Mar.
*Industrial Diamond Association of America—Mar.
Ingersoll Milling Machine Co., The—Mar., May, July, Sept., Oct., Nov.
*Ingersoll-Rand Co. — Mar., May, July, Sept., Nov., Dec.
*International Research & Development Co.—Mar., Apr., May, Aug., Sept., Nov.

J

♦Jacobs Mfg. Co.—Mar., Apr., May, Sept., Oct., Nov.
Jahn, B., Mfg. Co., The—Jan., Feb., Mar., Apr., May, June, Sept., Oct., Nov.
*Jarvis Corp., The—Mar., May, Sept., Oct., Dec.
Jergens Division,
Donley Products, Inc.—June
*Jergens Tool Specialty Co.—Mar., Sept.
Jes-Cal Co.—Mar.
Jessop Steel Co.—Mar., Apr., May, Aug., Oct., Dec.
*Jones & Lamson Machine Co.—Jan., Mar., Apr., May, June, Aug.
*Jones & Laughlin Steel Co.—Mar.

K

Kaufman Mfg. Co. — Jan., Apr., May, July, Sept., Nov.
*Kaydon Engineering Corp.,
Frauenthal Division—Jan., Mar., May, July, Sept., Nov.
Kearney & Trecker Corp.—Jan., Mar., Apr., May, June, July, Sept., Oct., Nov., Dec.
♦Keller Tool Division,
Gardner-Denver Corp.—Jan., Feb., Mar., Apr., May, July, Aug., Sept., Oct., Nov., Dec.
*Kenco Mfg. Co.—Mar., May, July, Sept. Nov.
*Kennametal, Inc.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
King Tester Corp.—June, Aug., Oct., Dec.
Kingsbury Machine Tool Co.—Mar., May, Oct., Dec.
Kling Bros. Eng. Works—Jan., Mar., May
Knight, W. B., Machinery Co. — Mar., Apr., June, Sept., Oct., Nov.
*Koebel Diamond Tool Co.—Mar.
Krueger Barnes Corp.—Nov.
*Kurt Orban Co., Inc.—Jan., Feb., Mar., Apr., June, July, Aug.

L

*Lamina Dies & Tools, Inc.—Feb., Mar., June, Aug., Oct., Dec.
*Landis Machine Co.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
*Lapeer Mfg. Co.—Feb., Mar., June, Aug., Oct., Dec.
Lapointe Machine Tool Co., The—Jan., Apr., June, Aug., Oct.
*Latrobe Steel Co.—Feb., Mar., May, July, Sept., Dec.
Lavallee & Ide, Inc.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
Lawley Granite Surface Plate Co.—July, Sept.
*Lee, K. O., Co.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
*Lees-Bradner Co.—Mar., May, July, Sept., Nov.
♦Lehigh Foundries, Inc.—Mar.
Leland-Gifford Co. — Feb., Apr., June, Aug., Oct., Dec.
*Lempco Industrial, Inc.—Apr., May
Lepel High Frequency Laboratories—Jan., Feb., Apr., June, Aug., Oct., Dec.
Levin, Louis, & Son, Inc. — Jan., Mar., May, July, Sept., Nov.
♦Lincoln Electric Co.—Feb., Mar., Apr., May, Oct., Dec.
Lincoln Gage Co.—Feb., Apr., June, Sept., Oct.
Lincoln Park Industries, Inc.—Jan., Mar., May, July
*Lindberg Engineering Co. — Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
*Linde Air Products Co.,
A Division of Union Carbide & Carbon Corp.—Jan.
Link Aviation, Inc.—Dec.
Lipe-Rollway, Inc. — Jan., Mar., May, July, Sept., Nov.
*Littell, F. J., Machine Co.—May, Sept., Nov.
*Lodding, Inc. — Feb., Apr., June, Aug., Oct., Dec.
*Logan Engineering Co.—Feb., Mar., May, Sept., Oct., Nov.
♦*Logansport Machine Co., Inc.—Jan., Apr., Aug.
*Lovejoy Tool Co.—Mar., Apr., June, Aug., Oct., Dec.

M

*Mac-It Screw Division,
Strong-Carlisle-Hammond—Mar.
Macklin Co.—Mar., Apr., Oct., Dec.
♦*Madison Manufacturing Co.—Jan., Feb., Mar., Apr., May, June, July, Aug., Oct., Nov.
Magnetic Holding Devices—Dec.
*Man-Au-Cycle Corporation of America—Mar.
*Manhattan Rubber Division,
Raybestos-Manhattan, Inc.—Jan., Mar., May, Sept., Nov., Dec.
Marac Machinery Corp.—Nov.
Marathon Electric Mfg. Corp.—Mar.
*Marvel Engineering Co.—Jan., Mar., May, July, Sept., Nov.
*Maserati Corporation of America—Mar., May
*Matthews, Jas. H., & Co.—Feb., Mar., May, Dec.
*Mayline Co.—Jan., Mar., Apr., June, Aug., Oct., Dec.
*MBI Export & Import, Ltd.—Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
McDonough Mfg. Co.—Jan., Mar., May, July, Sept., Nov.
McGraw-Hill Book Co., Inc.—Jan.
McKay Machine Co.—Mar., May, July, Sept., Oct., Dec.
*Mead Specialties, Inc.—Mar.
Mechanite Metal Corp.—Feb., Mar., Sept
Melin Tool Co., Inc.—Feb., Apr., June, Aug., Oct., Dec.
Mercury Engineering Corp.—Mar.
*Merrill Engineering Labs, Inc.—Mar.
*Metal Carbides Corp.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
*Metal Cutting Tools, Inc.—Mar.
*Metallurgical Products Department,
General Electric Corp.—Jan., Feb., Mar., Apr., May, June, July, Aug., Oct., Nov., Dec.
Metron Instrument Co.—Feb.
♦Meyers, W. F., Co. — Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
Michigan Tool Co.—Jan., Mar., July, Nov
Micromatic Hone Corp.—Jan., Mar., May, July, Sept.
♦*Micrometrical Mfg. Co.—Feb., Mar., July Sept., Oct., Dec.
Micro-Positioner Corp., The—May, July
Middlestadt Machine Co.—Dec.
Midwest Gage Division,
American Gage & Machine Co.—June
*Milford Rivet & Machine Co., The—Mar., May, June, Sept., Oct., Nov.
*Miller Fluid Power Division,
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Milne, A., & Co.—Mar., Apr., May, July, Oct., Nov.
*Modern Industrial Engineering Co., — Mar., Nov.
*Modernair Corp.—Jan., Mar., May, July
*Mohawk Tools, Inc. — Jan., Mar., May, July, Oct., Nov.
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*Moore Special Tool Co.—Feb., Mar., Sept., Oct.
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*Morrison Engineering Co.—Mar.
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*Motch & Merryweather Machinery Co., The—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.

N

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*National Broach & Machine Co.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
♦National Twist Drill & Tool Co.—Jan., Feb., Mar., Apr., May, Sept., Nov.
*Nelco Tool Co., Inc.—Jan., Mar., Apr., May, July, Oct., Nov., Dec.
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Greenleaf Corp.—Dec.
New England Tap Co.—Feb., Apr.
New-Field Machined Parts Co. — Mar., July
*New Hermes Engraving Co.—Dec.
New York Twist Drill Co.—Mar., May, Nov.
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Nice Ball Bearing Co.—Mar., Aug., Dec.
*Nikon, Inc.—Oct., Nov.
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♦*Nilsson Gage Co., Inc.—Mar., May, July, Sept., Oct.
*Noble & Westbrook Mfg. Co.—Feb., Mar., June
Nobur Mfg. Co.—Nov.
*Norgren, C. A., Co.—Apr., June, Oct., Nov., Dec.
*Northwestern Tool & Eng. Co. — Mar., May, July, Sept., Nov.
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*Robbins, Omer E., Co.—Feb., Mar., June, Aug., Oct., Dec.
*Rockwell Mfg. Co., Delta Power Tool Division—Feb., Mar., Nov.
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S

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*Schrader's, A., Son—Jan., Feb., Apr., May, July, Sept., Oct.
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*Superior Steel Products Corp.—Jan., Mar., May, July, Sept., Nov.
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W

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Z

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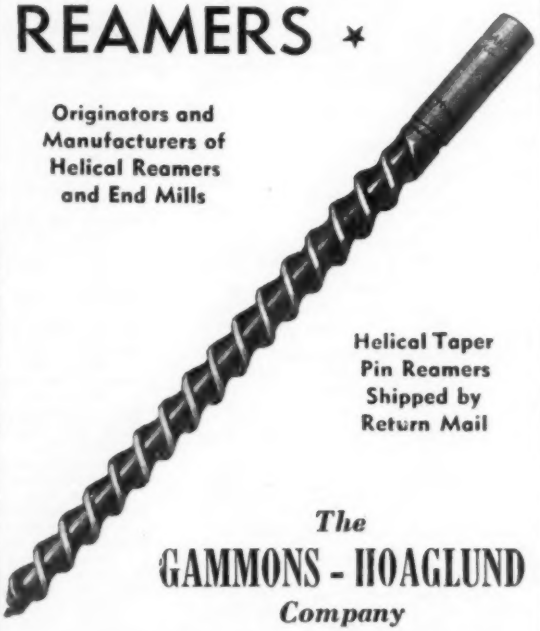

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December 1956 Issue

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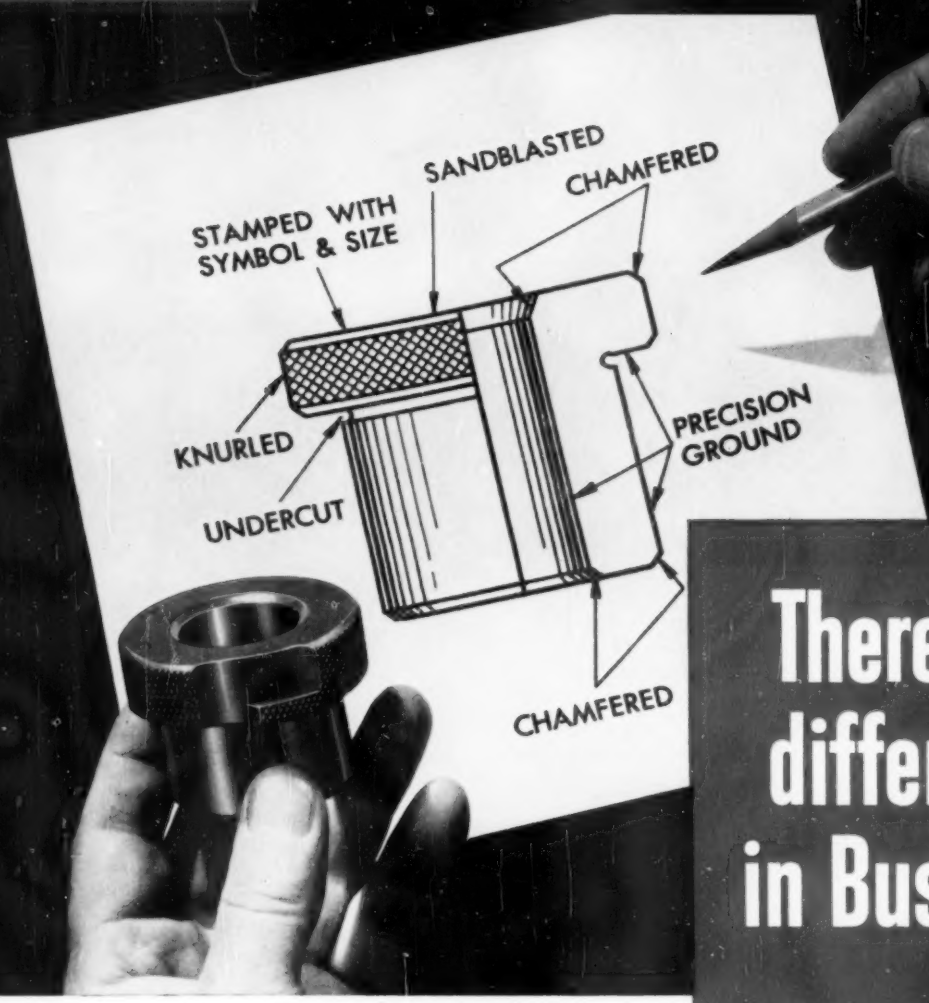

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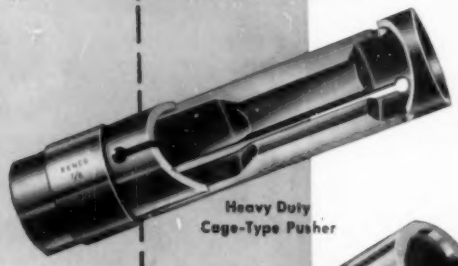
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